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VOL LXVII 20 SEPTEMBER 1952 No 1732

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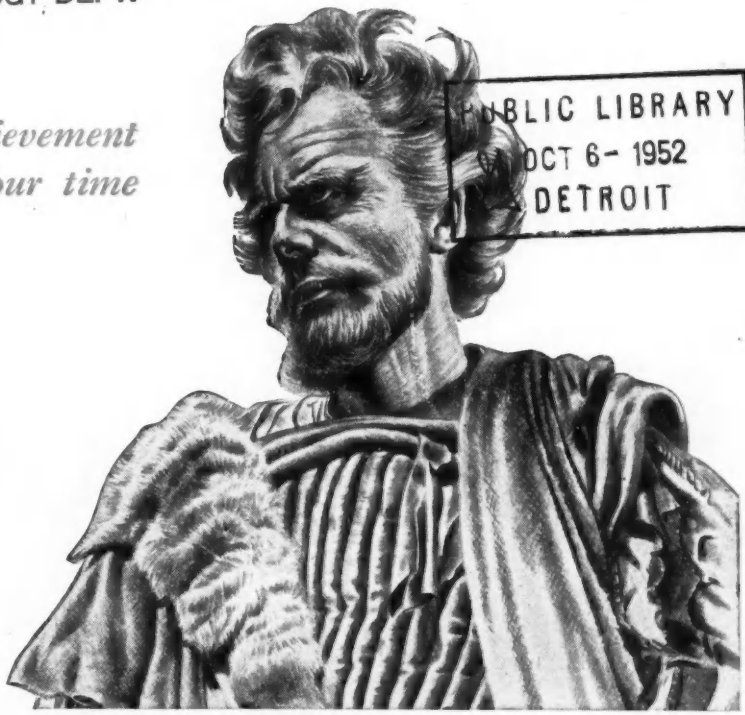

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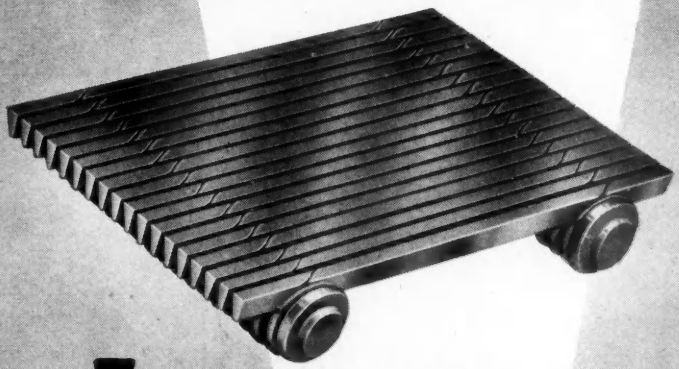

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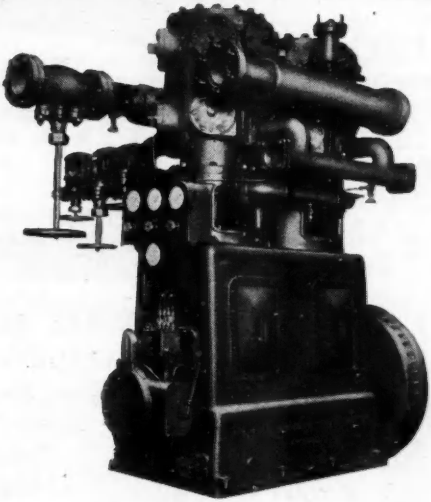

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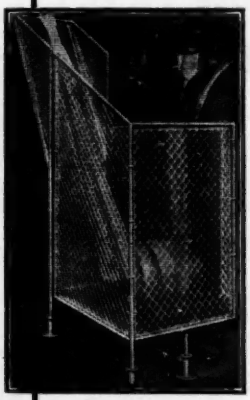

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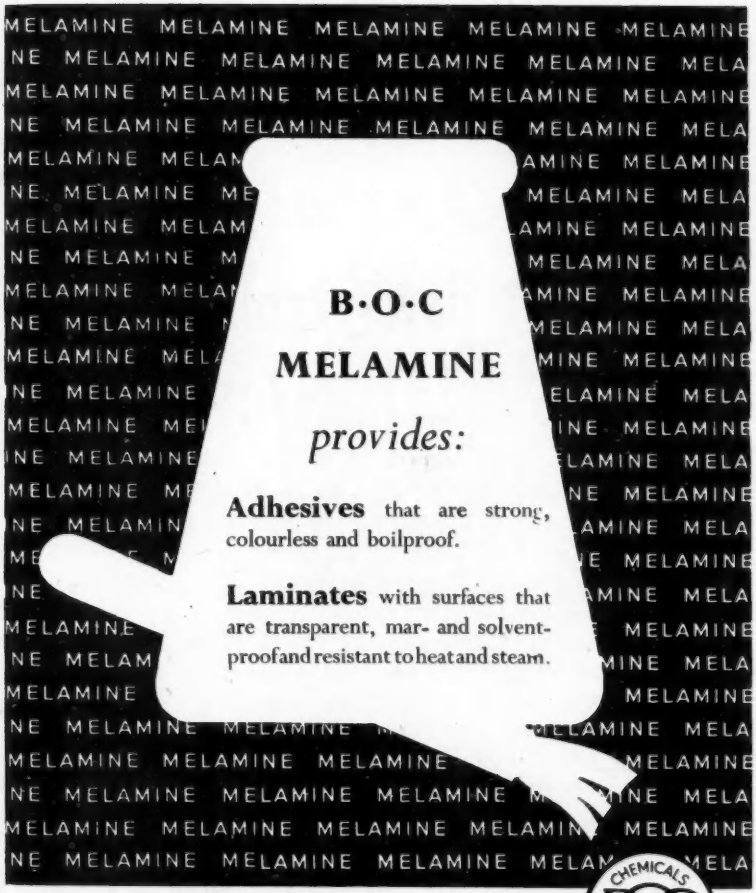
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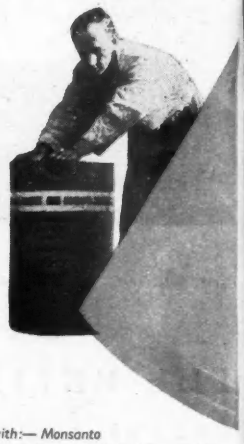

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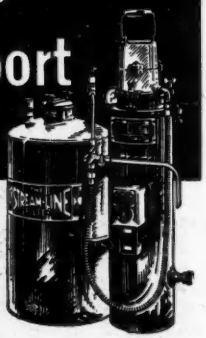

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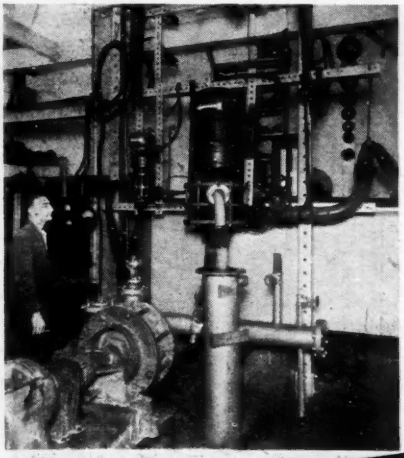

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Prospects for Chemurgy

IT is broadly true to say that only the Americans have taken chemurgy seriously. Nor is this surprising. There could have been no more compelling stimulus than the steadily rising crop surpluses of the 'twenties. A country the size of a continent with much of its land agricultural must inevitably pioneer processes by which harvests and harvest wastes could be converted into industrial materials. The post-war world food outlook—and Britain's critical position therein—may suggest that chemurgy can never be any of our business. Certainly it would seem impolitic to convert edible materials into structural materials. There are, nevertheless, specific food surpluses (as any 1952 plum grower could mention in trenchant terms) and there are inevitably many wastes, direct wastes on the fields and indirect wastes in food factories. The task of the chemurgist is to turn these unwanted commodities into useful materials and to do so on a sound, self-solvent basis. We have recently been reminded by Dr. F. N. Woodward (*Chemistry & Industry*, **35**, pp. 844-848) that it is only since the industrial revolution began that man has relied predominantly upon inorganic and non-renewable sources of raw materials; until about 1800 most of his non-food materials came from natural growth—wool from sheep, timber from forests, etc. Only in the past century and a half has the use of mined raw materials outstripped the use of materials of current biological production. And already we face exhaustion dates for some of the minerals upon which the industrialised world depends—copper, zinc, and lead deposits may well be emptied within one or two generations, petroleum reserves depleted by 2100. The truly biological product has the merit of being renewable—it is based upon photosynthesis, the harnessing of sunlight.

No one would seriously argue that soil in the British Isles should be devoted in any appreciable degree to producing non-food crops—even America today is concerned with chemurgy as a technology for utilising the wastes of crops. This American example is worthy of more attention. The United States is not deficient in many raw materials; we, by comparison, are much less well endowed (and much less explored). If chemurgical ventures pay in America, they should be no less profitable here. For as has been said this month in *The Observer* (7 September, 1952): 'The raw materials problem is the hard core of Britain's economic crisis,' and also, 'the scientific synthesis of new compounds, and the recovery of valuable materials from the

by-products of industrial processes, are the main basis on which the substitution of home-produced raw materials for imports will have to rest.' The words 'and agricultural' might well have been added in between 'industrial' and 'processes.'

There is a further beneficial aspect of the chemurgic development of crop wastes. A saleable by-product is created. Besides being an addition to national resources, it should—as do by-products of industry—help to ease production costs of the main product. This is certainly desirable, for any influence that eases, however slightly, the ever-rising cost of food production is of signal importance to Britain's new economy. America's chemurgic progress has undoubtedly been made possible by Henry Ford's long-sighted action in 1926 when he called a conference on the subject. As a result what is now known as the National Farm Chemurgic Council was set up, a body concerned not with research or finance, but solely with publicity and education. Public opinion was such that four official regional research centres have since been set up. Together they now spend some $8,000,000 a year on investigating chemurgic processes and possibilities. These steps—publicity, the survey, and research centres—have been the means of progress.

What has been achieved? Leaf wastes from root and green crops have been dried to produce protein animal feeding-stuffs, and small chlorophyll and carotene extracting industries have been established as subsidiary ventures. Winery wastes—lees, stones, pomace, etc.—have been developed as sources of tartrates; for these the United States is now self-sufficient where previously she was dependent upon imports. A vigorous pectin industry has been based upon citrus wastes. Bagasse from sugar-cane has been converted into building boards, 200,000 tons of bagasse being utilised annually. A new wax product is also being made from bagasse. Straw from cereal crops is being turned into board and to a lesser extent into paper. A notable development is the production of cigarette paper from seed-flax straw. We are indebted to Dr. Woodward for these examples of modern American chemurgy.

It is not implied that similar activities have been wholly neglected here or elsewhere. Europe has long used leaf waste from sugar beet as animal fodder; straw is converted into board here and to an increasing extent. What is so impressive in America's chemurgy is its scale and its co-ordinated development. Outside America the approach to chemurgy has been scattered and erratic. Yet the potentialities of chemurgic developments in Britain and the Commonwealth—above all, perhaps, in the Colonies—are enormous.

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Notes & Comments

The British Association

THE 1952 meeting of the British Association at Belfast has not been universally showered with praise or respect. 'A rather pointless get-together of scientific Rotarians' was one critical verdict, and this view received some support from *The New Statesman*, which appeared to deplore several aspects of the meeting. New discoveries are no longer announced at these annual conferences. The papers read are much too diffuse. There is a marked absence of middle-aged 'eminence' in the audience. The elderly scientists who dominate the proceedings tend to look backwards rather than forwards. It is easy to exaggerate these criticisms. After all, why should new discoveries be announced at these September annual gatherings? To delay such information to suit any once-a-year fixture might well result in serious loss of priority of claim. There are today many more suitable and frequently meeting bodies whose platforms may be used for reporting new advances. The British Association fulfils a better purpose if most of its papers take stock of the current state of science and on the whole that is what is now done. The papers may in some cases seem diffuse but they now have to cover complex and diverse fields—but are they as diffuse to scientists as to non-scientists? It is almost impossible to cater simultaneously for both types of audience. However regrettable it may be, the absence of middle-aged men of science is understandable. They are hard-pressed for time throughout the year and few can give up the week or more that British Association meetings require. If as a result veterans play the most active part in the proceedings, need this be retrogressive? Very often the veteran's perspective is the best from which to assess changing conditions. Some of the best presidential addresses of these meetings have come from men who must be classed as elderly rather than middle-aged.

Processed Peas

STRONG resentment of the remarks about processed peas, made by Professor W. Wardlaw, C.B.E., during his presidential address to the Chemistry Section of the British Association for the Advancement of Science (*see* CHEMICAL AGE, **67**, 319-324) has been expressed by Lt.-Col. M. W. Batchelor, chairman of the Fruit and Vegetable Canners' Association. 'The reference to processed peas,' he said, 'is grossly misleading and is greatly resented by all reputable manufacturers. The treatment of peas is in full conformity with the Food and Drugs Act, which sets the highest standard for the protection of the public. Only by processing peas can crops of short summer season be made available to housewives all the year round.'

Positive Legislation Needed

ONE can understand Colonel Batchelor's disappointment that the public should be made aware of exactly what processed peas are, but it is hard to see why he should be resentful. Professor Wardlaw told only the truth, and that is his obligation as a scientist and teacher. No one has said that processed peas are harmful, but they are not what the man-in-the-street believes them to be. If such countries as Canada and the United States can make fresh garden peas available to the housewife the year round there is no excuse for the British canner not doing likewise. Furthermore, it is becoming increasingly obvious that the Food and Drugs Act is hopelessly out of date and does not give nearly enough protection to the consumer. In our view British legislation regarding food is the poorest of any English-speaking country. The British chemist is fully aware of his responsibilities as a guardian of public health and is anxious to have positive standard-setting legislation to guide him rather than the negative edicts that exist at present.

New Silicone Announced

Union Carbide Make Silicone Oxyhydride

ANOTHER recent advance in silicone chemistry is the development of silicon oxyhydride by Linde Air Products Company, a Division of Union Carbide and Carbon Corporation, U.S.A. This speciality silicone has outstanding properties as a filler and blowing agent for rubber. It also possesses properties interesting for other types of industrial uses such as: a water-proofing component of greases, creams, and similar materials; a catalyst base, a chemical reducing agent; and a source of silicon sesquioxide.

Under the influence of heat or chemical agents, silicon oxyhydride can liberate 423 cc. of hydrogen per gram. This liberated gas is sufficient to produce a porous foam structure in natural and synthetic rubber gum stock during conventional curing operations. The residual solid is an effective silica filler of the type normally employed to impart mechanical strength to the finished products.

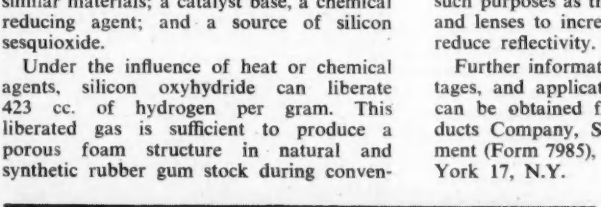
Greases and creams containing silicon oxyhydride are found to have increased resistance toward the deteriorating effects of moisture. This property may enhance the performance of such industrial products as industrial lubricants, cosmetics, and special purpose creams.

When silicon oxyhydride powder is suspended in solutions containing soluble salts of silver, platinum, and other metals, the rapid discoloration of the white powder indicates the deposition of reduced metal. Such material may prove to be quite effective for specific catalytic purposes.

The oxyhydride is also a reducing agent which may be useful for chemical synthesis where it is advantageous to employ a solid reagent capable of control by temperature of alkalinity.

On heating to 900°C. in the absence of oxygen, silicon oxyhydride forms silicon sesquioxide, similar in many respects to silicon monoxide, and may be employed for such purposes as the film coating of mirrors and lenses to increase surface hardness and reduce reflectivity.

Further information on properties, advantages, and application of this new silicone can be obtained from the Linde Air Products Company, Silicone Products Department (Form 7985), 30 East 42nd Street, New York 17, N.Y.



Shown here is an application of silicon oxyhydride as a blowing agent for rubber. Upon proper treatment, the amount pictured in the dish releases enough hydrogen to fill the balloon. The formula of the compound is shown on the blackboard.

Directorate Closed

The Ministry of Materials has announced that following the return to private trade on 1 July last of fertilisers and the raw materials for their manufacture, the Directorate of Fertiliser Supplies at Tunbridge Wells will be closed down on 30 September. From 1 October, 1952, all matters concerning the production and distribution of fertilisers in the United Kingdom will be dealt with at the Ministry of Materials, Branch 2A, Horse Guards Avenue, Whitehall, S.W.1.

The Chemical Engineer in Industry

Dr. E. H. T. Hoblyn Addresses British Association

On 8 September, the Chemical Engineering Section of the British Association (Section G) heard E. H. T. Hoblyn, M.B.E., Ph.D., A.R.C.S., F.R.I.C., M.I. Chem.E., the Director of the British Chemical Plant Manufacturers' Association deliver the following paper on 'The Chemical Engineer in Industry':—

IN any discussion on higher technological education, it is necessary to consider, among others, two factors—the part which the technologist is to play in industry and the contribution which industry must make to his training. This paper is devoted to these factors in so far as they concern the education and training of a chemical engineer.

The growth of the chemical industry in Great Britain, in the United States, in Germany and elsewhere has brought with it the realisation that chemical engineering is no haphazard admixture of chemistry and engineering, but a distinct technology in its own right—that it has, in fact, emerged as the fourth primary technology. Although comparatively young, the chemical engineer today stands shoulder to shoulder with the civil, mechanical and electrical engineer in contributing to the growth of the world's technological industries.

Lack of Technologists

During and since the war there has been a rapidly growing awareness of the lack of technologists in the United Kingdom. This shortage has resulted in others, notably the Americans, developing on a commercial scale the discoveries of pure scientists. 'Know-how' and designs in certain fields have had to be obtained from abroad, not because of any shortcomings in our native skill and ingenuity, but because there were not available the appropriately trained men in sufficient numbers to enable us to do the development work ourselves. As was pointed out in the Dunsheath Report, many Americans believe that their large numbers of chemical engineers have been an important factor in the rapid progress of industry in the United States.

It is not too soon, therefore, that so much attention is now being focused on increasing the facilities for training chemical engineers in our country. Since the war, industry has been active in putting forward its views and was instrumental, with the ready co-operation of the Ministry of Labour and National Service and the Ministry of Education, in establishing after the war short-term courses in chemical engineering to bridge the gap until more men were available from the normal university courses. These courses proved most valuable; they not only produced good men but many of them have since grown into full-time degree courses.

Work of the Chemical Engineer

Before discussing the part which industry must play in the training and utilisation of chemical engineers it is desirable briefly to examine the main types of work in which they find employment in the chemical and allied industries including the gas and oil industries. These are research, development and design of plant, construction and installation of plant, process control and plant operation, and plant maintenance. The nature of the work, the type of man employed and the level of his qualifications all vary from job to job and from section to section of the industry.

Chemical plant manufacturers use chemical engineers for research and for designing and installing plant and handing it over to the customer operating satisfactorily. Such work is basically the same whether the plant is to be used in the chemical, gas or oil industries and requires to be carried out by fully qualified chemical engineers of high technical ability and preferably having had some plant-operating experience. The plant manufacturer also employs chemical engineers on his sales staff. The chemical and allied industries employ chemical engineers in two very different spheres which require different levels of educational attainment in the subject.

In the first place, the chemical industry uses chemical engineers for research and development and the subsequent design and installation of plant for its own particular processes. This often involves the linking up of specialist equipment supplied by a number of plant manufacturers. Such work

may also include the costing of the plant and process and its comparison on technical and commercial grounds with an alternative process. A fully qualified chemical engineer is required for such duties and he must work closely from the outset of the project, on the one hand with the chemist who has evolved the process in the laboratory and on the other with the civil, mechanical and electrical engineers who will be concerned with the erection and servicing of the plant and the structures which support it or the building which houses it.

Number Needs Increasing

The chemical industry also employs chemical engineers for plant operation and process control. While large numbers are employed in this way, the number could, with advantage to productive efficiency, be greatly increased, if men with the right type of training were available in sufficient numbers; a lower level of training can normally be accepted for such work for which Higher National Certificate chemical engineers, to whom reference is made later, should be admirably suited.

The oil industry and the gas industry, like the chemical industry, use chemical engineers for design and development work and for process control and technical supervision.

It is clear, therefore, that in the chemical and allied process industries and in the engineering industries which serve them, there is tremendous scope for chemical engineers of varying levels of competence and inclination. What, then, does industry require in their training?

Industry and the Education of the Chemical Engineer.—There has always been a close and mutually valuable relation between British industry and the universities; as a result, courses in chemical engineering, as in many other subjects, are usually a sound blend of the ideas of academy and industry. Opinions on the method of training a chemical engineer will obviously differ as they do in the case of the training of any other technologist. There is little doubt, however, that the four-year undergraduate course to an honours degree is now accepted as the most usual form of training for a top-grade chemical engineer. It is important to stress that the chemistry and engineering content of the courses leading up to the study in the final year of chemical engineering proper should always be planned with that end in view. Chemistry and engineering must be taught for chemical engineering and there must be no stuffing of the student with facts at the expense of fundamental principles.

For example, there is no need for the student to be familiar with a wide range of complex organic syntheses but he should have a clear understanding of the functions of oxidation, reduction, esterification, saponification, and so on, in organic chemical processes and of the wide applications of reactions such as the Friedel-Crafts and the Grignard and the conditions under which they have to be carried out. Similarly, his engineering training should be directed towards a clear understanding of such questions as the flow of fluids, the transfer of heat, the strength of materials and its application to vessel design rather than towards, for instance, a study of mechanisms. It is to be hoped that eventually more of the early training will be given in the chemical-engineering departments themselves.

Courses vary from college to college and it is desirable that they should and that each college should build up its own tradition for producing a man with a certain type of training. Depending upon the nature of the work for which the new entrant to industry is required, so should the prospective employer be able to lean towards the products of a particular school of chemical engineering.

Originally, chemical engineering was taught as a post-graduate subject to graduates in chemistry, physics or engineering. Such courses still and must exist for the benefit of those who at a later stage in their academic careers decide to study chemical engineering rather than to proceed to research work in their subject of graduation.

Most Significant Advance

The most significant advance which has been made recently in the scope of chemical-engineering training is the establishment of Higher National Certificates in the subject; the courses to the H.N.C. will be taken by students holding a National Certificate in chemistry or engineering. Industry should welcome these new courses which will produce what have already been described as the N.C.O's of the chemical and chemical-plant industries. It is for industry to ensure that sufficient raw material is forthcoming

from its ranks to warrant the establishment of H.N.C. courses in various centres.

It must also ensure that it uses these N.C.O's properly; first, they should be employed at a level of work suited to their training—in some cases this should enable better qualified men to be released for more responsible duties, while in others it should enable more chemical engineers to be used on duties for which at present they are sadly lacking, such as plant and process control, as mentioned earlier.

Secondly, industry must provide the N.C.O. with the incentive of promotion, where competent, to commissioned rank. Care must be taken by those concerned that H.N.C. chemical engineering courses are not established in centres which are so close together that they compete for students. It is far better to have fewer courses and that those courses be good and supported by properly equipped laboratories.

Industry's Part in Education.—One of the comments made by witnesses to the Chemical Engineers' Sub-Committee of the Hankey Technical Personnel Committee was that 'Chemical engineering is essentially an applied science. . . . The object of a university training should not be to turn out a ready-made chemical engineer, but to teach a man to think along the right lines so that after practical experience he can become one.' Industry, therefore, must make its contribution to the education of the chemical engineer by being prepared to train him further after he leaves the university.

Short Trainee Courses

In this connection the graduate must come to industry in the proper frame of mind and there is an onus on the teaching staffs to ensure that students do not leave the universities feeling that they are a Heaven-sent gift to industry. Some firms in the chemical-plant field and elsewhere have developed two-year trainee courses for chemical engineering graduates which not only give the men extended training while employed, but also enable the employer to determine the type of work for which a given individual is best suited. At the end of these courses, the trainees are free to go elsewhere should they so desire.

In addition, industry must help the student while he is still at the university by providing facilities for vacation and sandwich courses. There is, understandably, a school of thought which prefers the student to do something totally different during his long vacation, but most students prefer to obtain practical experience at some time during this period.

Vacation Training Schemes

Many firms now have excellent vacation training schemes from which the student can gain real benefit. It is imperative that firms accepting students for vacation work should do so with a full sense of their responsibility in assisting in their training and that close liaison is maintained between the firms and the students' professor. Examples of the type of work on which students can be employed are operational tests on plant or the carrying out of pilot-scale work in connection with some research problem.

There is also good reason to devote one vacation to working on the shop floor. This does not mean that the student should spend hours learning to file flat or to operate some machine tool. He can, however, work on the assembly of plant in the shops, learning from this good and bad features of design; he can gain some knowledge of the foundry and its problems by working as a mate to a good moulder; physical operation of a plant which does not readily lend itself to modern methods of automatic control will provide an experience the value of which cannot be lost.

There is also a vitally important human aspect of this type of vacation work—it brings the student right alongside the workman; he learns something of his outlook on life, how he thinks, how he works out problems and above all he learns how to get on with him. Many first-class technical men have failed in plant work because they possessed the unhappy knack of upsetting workpeople.

Works experience can also be obtained by sandwich courses which can be developed into something of real value to industry as well as to the student. The report of the Cremer Committee on Chemical Engineering Research pointed out the need to collect and analyse data from large-scale plant operation. Work of this nature could be carried out by a team of students working under appropriate guidance. There have already been cases in which students on vacation courses have carried out tests on plant, and the data they have collected has led to

modifications resulting in greater efficiency of the plant.

Investigations on the actual working plant, planned jointly by the teaching staff at the university and the technical staff of the company concerned, and carried out under supervision during the students' actual course, should be developed on an increasing scale in this country. This use of industry as the chemical-engineering laboratory has met with great success at the Massachusetts Institute of Technology, and there is no reason why it should not do so in this country.

Another and totally different aspect of the contribution which industry must make to the training of the chemical engineer concerns particularly the man working for the Higher National Certificate or other external qualification. First, he must be so stimulated that he wants to become a chemical engineer. Then, once he has embarked on this course, those responsible for his work must take an active interest in his studies and by precept and practice indoctrinate him with their own trained methods of working. For such a man, industry is his only university and therefore his boss must try to be his professor.

As for the future—figures have been published recently of the estimated future demand for chemical engineers, but, with the ever-growing appreciation of the part which the chemical engineer can play in industry, these estimates may well prove to be low. It is certain that facilities for chemical engineering training in this country will expand rapidly over the next few years, but at the same time there must be no relaxation of teaching or qualifying standards. In this respect, it is fortunate that the Institution of Chemical Engineers has such a keen sense of its responsibility for maintaining the high standard so properly demanded by the profession.

Training Chemical Engineers

Combined Action by Industry & the Schools Required

The subject chosen by Professor D. M. Newitt in his address to the Chemical Engineering Section of the British Association in Belfast on 8 September was 'The Training of Chemical Engineers'. Professor Newitt spoke as follows:—

THE rise of chemical engineering as a primary technology is one of the direct consequences of industrial and economic developments which are still taking place. It may be said to owe its origin to the big expansion in the heavy chemical industry and to the simultaneous growth of new industries, resulting from intensive scientific research during the latter half of the Nineteenth Century.

There was at that time a growing conviction that empirical methods of plant design, based largely upon trial and error, could no longer meet the needs for better process control and for higher operating efficiencies and would have to give place to more scientific procedures. George E. Davis, one of the pioneers of chemical engineering, first began to lecture on the subject in 1887, and his well-known 'Handbook of Chemical Engineering' was published in 1901. The introductory chapters of this book will deserve to be studied by anyone in doubt as to the true functions of a chemical engineer.

The new branch of engineering, however, made slow progress in this country and, as has so often happened, it was left to Germany and America to build up those renowned schools of chemical technology and chemical engineering which, during the inter-war years, gave them such an outstanding lead in the international race for higher industrial productivity. We now have to face the task of recapturing some of the lost ground and, by increasing our facilities for higher technological education and vocational (technical) training, of making available to industry the skilled men required, at all levels, for the purpose.

But, in the interval, the picture has changed and the problem has increased in scope and complexity. Technological, economic and social factors are now so closely interwoven in the structure of the modern state that higher technological education must aim at providing not only for the vocational requirements of the technical specialist but also that wider culture essential to those destined for leadership in industry and commerce. It is in this broader

context that the training of chemical engineers should be considered.

Perhaps, the best approach to the subject is by way of a statement of objectives based upon the needs of industry and the exigencies of the present economic situation. There is a great deal of evidence to suggest that our industries have, over the course of years, lost the initiative in the development of new processes and products; and numerous examples might be quoted in which inventions and discoveries made by our scientists have been left for exploitation abroad. The growing practice of paying royalties to our competitors on this count is, in every respect, undesirable; not only is purchased 'know-how' always out of date, but the practice denies to our technologists those opportunities for widening their experience and displaying their skill and initiative which are so necessary if we are to compete on level terms in the world's markets.

To meet this situation requires combined action by industry and the schools. The objective of a chemical engineering training is, in the words of Professor W. K. Lewis, 'The development of the capacity of the student when faced with a new and unfamiliar situation, to handle it with a competence, involving skill, initiative and leadership.' Industry must ensure that, when such men are available, opportunities are offered for the exercise of their talents; its responsibilities, however, do not end here and reference will be made later to ways by which it may with advantage make a contribution in the educational field itself.

Disposal of Misconceptions

It may be well, at this stage, to dispose of certain misconceptions which exist in regard to the nature and scope of a chemical engineering curriculum. In the first place, it must be recognised that the subject constitutes a distinctive discipline which embraces the whole of that body of applied science utilised in transferring a process from the laboratory stage to large-scale production; it is, in addition, concerned directly or indirectly with the economics of production and with the social implications of new scientific discoveries.

The range of subjects to be covered is, therefore, extensive and any endeavour to insist upon a high degree of proficiency in all the sciences included in the definition would be impracticable. A thorough grounding in the fundamental principles of the physical sciences is essential but attention should, thereafter, be directed towards those special applications which constitute what are now generally known as the unit operations and unit processes of chemical engineering.

It will be clear from these considerations that endeavours to base a first degree course in chemical engineering upon any synthesis of existing courses in chemistry, physics and mechanical engineering are unlikely to be successful. The only feasible compromise is that by which chemical engineering may be taken as a post-graduate subject following upon a first degree in chemistry or mechanical engineering; this method, however, involves an additional one or two years of study and carries with it no very tangible compensating advantages.

Emphasis on Works Experience

From the educational point of view, one of the important problems common to all categories of technology is the emphasis which should be given to works experience as an integral part of a university training. The purpose of introducing a student to industrial life during his university career is to impress upon him at an early stage that this work has to form part of a complex structure, other component parts of which are labour and management. Up to a point, this can be done by instruction in the principles of industrial management and in the economics of production, but nothing can replace the first hand experience gained by direct contact with men and things.

Two alternative methods have been adopted to this end in this country, the one based upon vacation work and the other upon sandwich courses; in the former, the student is expected to devote some eight weeks of at least two long vacations to employment in a works; in the latter, more extended periods of employment are sandwiched between attendance at the university. There is not much to choose between the two and both depend for their success upon the student being able to identify himself with the routine and life of the works and being given definite duties and responsibilities. In all circumstances, he will pick up something of value from such industrial contacts and, when the courses are carefully planned, the benefit he obtains is important and far-reaching.

In general, first degree courses in chemical engineering extend over three post-intermediate years, the first two of which are devoted to the physical sciences and to certain branches of mechanical engineering and mathematics and the final year to unit operations and processes. It cannot be held that such a short period is sufficient to enable any comprehensive syllabus to be covered in its entirety, and it is particularly important to guard against the dangers of introducing so much detail that the student fails to obtain a broad perspective of his subject. For this reason, an extension of the course to a fourth year, with all the formal apparatus of lectures, tutorials and examinations, is not altogether desirable. The atmosphere of impending examinations is not conducive to independent thought and inquiry; and, if we wish to foster and develop initiative and enterprise, there must be a period during which the student can, under direction, begin to apply his knowledge. In some respects, this end is attained by one or two post-graduate years devoted to original work. In the case of selected students the time so spent is undoubtedly of great value. The planning of a systematic piece of research, the devising of new experimental methods and techniques, the critical appraisal and discussion of results bring out qualities in a student which no system of examinations can hope to reveal. But it must be recognised that all students are not temperamentally or intellectually fitted for research work and no useful purpose is served by forcing them to spend one or two years in a distasteful occupation.

If we remember, however, that the technologies aim at the application of fundamental principles to practical problems and at the introduction of new methods and techniques into industrial practice, it becomes possible to devise a post-graduate course which will entail investigations of a more practical character than those generally included under the heading of fundamental research.

Investigations by Students

There is no reason why such investigations should not, in suitable circumstances, be undertaken by teams of students rather than by individuals and in co-operation with industry rather than in the isolation of a university laboratory. This matter has been referred to indirectly in the Cremer Report on Chemical Engineering Research, which emphasises the importance of the functional analytical approach to chemical engineering research.

As the result of such a system of training, the graduate should enter industry with a background of fundamental science, with some knowledge of industrial organisation and with a sound understanding of the basic operations of chemical engineering. He will not be familiar with the practice of any one industry nor with those technical details of plant operation which can only be acquired by works experience; and it must be recognised that some time will elapse before he can be expected to make his full contribution as a technical specialist. He should, however, be competent, at the outset, to undertake design and development work and to bring to it those qualities of initiative, originality and adaptability which are so urgently needed in industry today.

Finally, it will be evident that chemical engineering differs essentially from those technologies which are confined to the principles and practices of particular industries or of groups of related industries and that chemical engineers can, by the generality of their training, be regarded as a mobile force of technologists able to move from industry to industry as economic conditions dictate.

Cosmetic Chemists' Plan

THE Council of the Society of Cosmetic Chemists of Great Britain is to make every effort during the current year to increase the standing of the Society in the fields of the technical application of science to industry. In a letter to members it is announced that arrangements have already been made to hold meetings in the Conference Room of the British Colour Council, 13 Portman Square, London, W.1, on 12 November, and 5 December, 1952; 6 February, and 3 March, 1953. The subjects will be hair, detergents, and dyes.

In addition to this, a meeting for the purpose of considering the proposed new rules will be held on 23 October at St. Ermin's, Caxton Street, London, S.W.1. An intensive membership drive is planned to enable the annual subscription to be kept at £2 2s. The hon. secretary is F. Hulley, 'Sherborne,' Yew Tree Road, Dorking, Surrey.

In the Editor's Post

Ion-Exchange Resins

SIR,—As an assiduous reader of your paper, we found in No. 1724, of 26 July, 1952, page 117, an article on 'Some Industrial Applications of Ion-Exchange Resins.' We take the liberty to make the following remarks regarding its contents, as we feel that poor justice is done to our company, which has, since 1934, devoted its energy to the field of ion-exchangers, thus having in our opinion contributed to a considerable extent to its actual status.

While it is far from us to denigrate the great importance of the work of Messrs. Adams & Holmes, it is nevertheless true that the discovery of the first acid-resisting cation-exchanger, marketed under the name of 'Dusarit,' was made by our company in 1934; the application for the Dutch patent is dated 19 January, 1934. It is a sulphonated coal. It has since found a widespread application all over the world. We feel that this fact should not have been left out.

On page 118 the article mentions the mixed-bed purification and it is stated that this was an invention of the British Permutit Company during the war. We should like to draw the author's attention to the fact that on 18 October, 1939, we applied for a demineralising patent, in which we say: 'In some cases a mixture of cation- and anion-exchangers can be used' and we feel that with this claim here again we were the first to indicate this possibility.

We should be grateful if you would feel inclined to give these corrections a small place in one of your next numbers. Thanking you in advance, we are.—Yours,

D. RAMONDT.

Industrieele Maatschappij Activit N.V.,
Amsterdam.

Foot & Mouth Disease

SIR,—Foot and mouth disease among cattle constitutes a challenge to chemists which is doubtless being taken up by those best qualified to solve the problem, but is the cow being allowed to help?

Fifty years ago the cows of my acquaintance were always given a 'salt lick' near their drinking trough. I was reminded of this by a statement of a friend on holiday in the West Country, who was told by a cowman that he did not fear foot and mouth disease for the cattle under his charge and pointed to his salt lick, a block of natural rock salt.

If my memory is not at fault cows using the salt lick would first drink then lick the rock salt and follow this by prolonged licking of their lips and nostrils. It may be the curative effect of the licking or some impurity in the rock salt—at present only the cow knows.

That nature has given the animals a cure for their ills and a natural instinct to employ it is self-evident in their very existence. Dr. Fernie ('Animal Simples,' p. 110) says of the cow 'But among all animals slaughtered for food the greatest sinner in the matter of liability to propagate tuberculosis disease in those who eat its flesh or drink its milk is the dairy cow and this mainly because she is a domesticated animal subject to artificial treatment as to feeding and housing.'

The significance of the final sentence should not be lost to those seeking a cure for foot and mouth disease. If anyone doubts the reality of natural instinct they should have witnessed a recent television programme in which the rate of growth of the root of a bean was speeded up several hundred times. The instinct of the root to grow downwards was shown and more amazing, the root's ability to avoid a poison, in this case a piece of copper. It was shown that by removing the tip of the growing root its natural instinct was destroyed and it made contact with the copper and died. The natural instinct of a cow must be more highly developed than that possessed by the tip of a growing root.

Can one find the cure for foot and mouth disease by giving full rein to the cow's natural instinct? If a diseased and unaffected cow were to be turned into the New Forest what would be its reactions? My natural instinct fogged by science tells me the cow would seek a cure from the leaves of trees, probably the elm. It may well be that it was the medicinal value of leaves rather than their food value that turned the cow into a giraffe. It is well known that the milk of goats is less tubercular and this may be because the goat has discovered the medicinal value of bark.

Another instinct of cows may be related to the spread of foot and mouth disease to their feet. Probably the affected feet feel

hot in the early onset of the disease. It is known that cows will stand for hours in muddy water and the suggestion that this is to keep off flies will not bear a close observation of their behaviour. A big game hunter has observed buffalo and their behaviour to water. He has observed that they will travel miles to reach water but some will not enter the water and others that do often do not drink. The herd instinct would account for the buffaloes following those who feel the need to stand in the water for curative purposes. They may increase the curative properties of the mind by their own movements.

Boussingault (*Lancet*, 23 August, 1845) wrote: 'Cows' urine contains bicarbonate of potash, so that with the urea, the hippuric acid and this salt it curiously resembles an alkaline mineral water.' As a chemist I bow my head and continue the quotation: 'I speak more seriously than you will be disposed to believe when I say that I should have more confidence in the urine of one of my cows than in an alkaline solution prepared by many a celebrated chemist.'

If history, notoriously romantic and unreliable, can be believed, it was a milkmaid who cured smallpox by observing that having had cowpox she was immune to smallpox. The remark had to be made to a Dr. Jenner. Who will be the Dr. Jenner to the cowman's remark quoted above?

May I end as I began: in the cure of foot and mouth disease let the cow help.—Yours, etc.,

'Radical.'

London.

Reduction in Alcohol Prices

THE Distillers Company, Ltd., has decided to reduce their selling prices of industrial alcohol as from 15 September. This is in anticipation of a fall in the world prices of molasses, but is only made possible at the present time by writing down large stocks of molasses and alcohol by a considerable sum out of reserves previously created for such a contingency. This step has been deemed necessary at this stage in order to assist users of industrial alcohol and its derivatives, whose trade, both home and export, has been adversely affected by the present high prices resulting from the abnormally high cost of molasses. Corresponding reductions have been made by The Methylating Company, Ltd., in the prices of methylated and other denatured industrial spirits.

Smoke Abatement

THE 19th annual conference of the National Smoke Abatement Society will be held at Portsmouth from 24 to 26 September.

Proceedings will begin with an official welcome by the Lord Mayor of Portsmouth on Wednesday morning followed by the presidential address by Professor F. E. Tylecote, Emeritus Professor of Medicine, University of Manchester. In the afternoon the third Des Voeux Memorial Lecture will be given by W. R. Hornby Steer, LL.B., on 'Smoke and the Law.'

Among the progress reports which will be discussed in the morning session of Thursday will be: 'Air Pollution and Cancer of the Lung,' by Dr. Percy Stocks, Senior Research Fellow, British Empire Cancer Campaign; 'Report from the U.S.A.,' by Henry Burns, senior inspector, Air Pollution Control District, County of Los Angeles, U.S.A.; and 'Review of Fuel Research Station Investigations,' by Dr. E. T. Wilkins, superintendent of observations, Atmospheric Pollution Research, DSIR.

Incentives for the prevention of industrial and domestic air pollution will be discussed in the afternoon.

On Friday morning Professor R. J. Sarjant, Professor of Fuel Technology, University of Sheffield, will discuss 'Pollution Problems in the Iron and Steel Industry.' The programme ends with the annual general meeting of the society.

Arrangements have been made for delegates to visit the power plant of the Sewage Outfall station on Friday afternoon. This installation is of particular interest as it is operated by one of the few remaining beam engines in the U.K.

A Joint Committee consisting of representatives of the Royal Society and the University of Cambridge have appointed DR. R. J. EDEN, M.A., Ph.D., of Cambridge University to be Smithson Research Fellow for four years in the first instance from 1 October, 1952. Dr. Eden will work on the 'Theory of Fundamental Particles' at Cambridge University.

Research on Cement

Sir Ben Lockspeiser Opens Symposium

SPEAKING at the opening of the Symposium of the Chemistry of Cement at the Royal Institution on 15 September, Sir Ben Lockspeiser, Secretary of the Department of Scientific Industrial Research, said there was no competition between the research done in Government laboratories and that done by the industry itself. The Symposium was the outcome of a combination of industry and Goverment, and reflected their close working relations. Continuing, he said:—

Cement and concrete are major constructional materials which have revolutionised civil engineering construction and radically affect all branches of building. The world output of cement is now at least 120 million tons per annum. If we convert this into concrete it means something approaching 500 million cubic yards or enough to girdle the equator with a road 150 ft. wide, 8 in. thick. Concrete has a major part to play in increasing the uses of the natural resources of the world. Nowhere is this need greater than in the large undeveloped areas where improvement of communications, irrigation and flood control, and development of hydroelectric power, depend largely on the use of concrete.

Ten Million Tons in 1951

Here in Great Britain we produced, in 1951, 10,000,000 tons of cement, of which some 2,000,000 were exported. The value of the products made from it, and of the concrete that is placed, are estimated to be of the order of £180,000,000. This is very substantial and warrants a correspondingly large research effort. It is, indeed, over one-third of the value of our steel production.

Activity in research on cement and concrete is considerable. In my own department it forms an important section of the work of both the Building Research Station and the Road Research Laboratory. The Cement and Concrete Association Research Laboratory at Wexham Springs, supported entirely by the cement manufacturers, is devoted to work on the use of concrete for the service of concrete users. The interest of the cement producers in research is also exemplified by the new research laboratory opened this summer by our largest manufacturers. Engineering research on concrete is to be found in various of our universities, but with one notable exception there is no corresponding university research on the physics and chemistry of cements.

This suggests a lack of balance in our research effort. In these days particularly, a heavy emphasis is being placed on applied research devoted to the solution of practical problems and the overcoming of industrial difficulties. This is right enough, but not so right that we can afford to neglect fundamental research in any subject. The organisation of research is not unlike running a business. There is a trading account and a capital account, and no sensible businessman would undermine his capital position to promote sales.

Proportion of Effort

Similarly, scientists must not sacrifice the capital of their business to immediate needs, and it is of first importance that a due proportion of effort be devoted to fundamental inquiry. This provides, by the accumulaton of knowledge, not only the surest basis we know of for the solution of the problems of the future, but it provides also the intellectual climate which promotes discovery and the growth of new ideas. Revolutionary advances in science are often unexpected, and, if we are wise, we will allow something for scientific adventure, which may be priceless.

The total effort devoted to cement and concrete research adds up to a substantial amount, but I still doubt if it is large enough. The total expenditure on it in this country—and estimates can only be very rough—is probably less than one-fifth of 1 per cent of the total value of the products made from cement. I suspect that the figures for many other countries may be much the same. There is clearly still ample room for expansion of research.

Cement research is a branch of silicate chemistry. Silicate have a wide industrial importance; they form one of the major interests of the geologist; because of the complexity of their structure they hold a very special place in crystallography and X-ray structural analysis. Work at high tempera-

ture on silicates finds application in such diverse subjects as cements, the petrology of the igneous rocks, metal refining, refractories, insulators, ceramics, and that new field of sintered metals and oxides which has acquired the ugly title of 'cermets.'

Not only has the work of cement chemists contributed to these varied fields, but the methods used and the theories developed have also formed a basis for subsequent studies in the whole field of high temperature chemistry. This is an expanding branch of chemistry, called into being by the need for a better understanding of many high temperature processes and by the requirements of new or improved materials to withstand high temperatures. Workers in cement chemistry are among its pioneers.

Unforeseeable Connection

It is always interesting to trace unforeseeable connections between one branch of science and another. Tobermorite is a very rare natural mineral first described in 1880 by Professor Heddle, who recognised it as a hydrated calcium silicate. Its true nature remained unsolved until 1952 when the first detailed X-ray data on the principal silicate constituent of hydrated cement were published. At the same time the collection at the British Museum was being re-arranged and an X-ray powder diagram of tobermorite was taken. It was identical with this calcium silicate hydrate. Thus it transpires that Heddle's rare mineral is synthesised daily throughout the civilised world, and to such an extent that millions of tons of it are produced annually in Great Britain alone.

This symposium, like its predecessor, indicates the degree and variety of research that has been carried out on cement in many countries, research which has delved deep into its fundamental chemistry and physics (although I think we should do more of this) as well as into problems of its application. It has been equally important to both producer and user, and their share in the common effort is reflected in the names of the various authors who have contributed to papers you are to discuss. Cement research has been, and remains, a truly international effort, and your attendance at this meeting is in itself a symbol of this co-operation and of the wide common interest that exists.

After Sir Ben Lockspeiser had opened the Symposium, an address of welcome to the delegates was given by Sir Francis Meynell, R.D.I., Director, Cement and Concrete Association, and vice-president of the Symposium. He said:—

My duties are in a sense humdrum because they form part of a ritual, a very proper ritual: every opening speech must give a welcome, must it seems, make a brief historic survey, must certainly extend thanks. That puts I think you and certainly me in a difficulty. What is ritual so often becomes insincere; and oddly enough what is insincere very often becomes terribly long-winded—as one who has only a little butter spreads it exceeding thin over a vast deal of bread. You perhaps know the story of the American orator: He was by nature long-winded. After half an hour of garrulity he said 'See here folks, I haven't a watch, but there are a few points more that I want to make.' After another half hour he said 'I haven't a watch, but bear with me a little longer.' When, for the third time, he was about to explain again that he hadn't a watch, a voice from the back of the hall said 'You may not have a watch, but there is a calendar on the wall over there.'

Sir Ben Lockspeiser has offered you the hand of welcome, a hand in his case, which directs, like a conductor's, the research of government organisations, a hand which soothes the brow and replenishes the pocket of many industrial research organisations, a hand which beckons those industries which lag in research, a hand which may even hold a smack in it.

The DSIR

The Department of Scientific and Industrial Research of which he is the Secretary, maintains its own research organisation but also supports financially the approved research organisations of industry. It happens that my own Association does not look for financial help, but the organisations of the iron and steel and cotton and motor industries (and many others) certainly do. I harp on this, for it is a portent. I know of no country in the world where you have quite this combination; private enterprise and close government co-operation and support without interference. This co-operation is not merely financial, it does not exist only at the high and visible levels: it exists all the way down. If we of the CACA need to borrow lecturers or equipment for a special training course, the Building Research Station and the Road Research Laboratory are always willing to lend.

It seems improper that I should take so much time—and I intend to take more—in talking about us, your hosts. It is rather like the actor who met an old friend, not seen for many years, in the street. He gave him a history of his successes, his tours, his press notices. Suddenly he interrupted himself 'Bless me, bless me,' he said, 'I've done nothing but talk about myself. Let's talk about you. Tell me, did you go to my last play?'

So now let's talk about *you*. Do you realise that we of the CACA are supported wholly by the Cement Makers? Do you appreciate the fact that we have 40 technicians? Do you—I want to go on talking about you—do you know that during the 16 years' life of the Association, out of which nearly six years were lost to the war, the annual cement production of the Cement Makers increased from 5,793,000 tons to 10,086,000 tons. Do you know that we have published over 500 booklets and leaflets and have distributed of them a total of more than eleven million copies, and that we have taken a leading part in the formation of the Pre-stressed Concrete Development Group—here we must pay special tribute to France and to Belgium—and of the Pavings Development Group (Concrete and Soil Cement). We practised for this Symposium by staging the Pre-stressed Concrete Statically Indeterminate Structures Conference (September, 1951) and the Symposium on Concrete Shell Roof Construction (July, 1952). Have you seen our Concrete Quarterly, or our Magazine of Concrete Research?

Result of Four Years' Research

You will be going to our Research Station; and you will see there what progress we have made in the four years of our research effort. We have one new building, various old buildings adapted, and plans for new ones which will include a physics and a chemistry laboratory. But you must realise that our preoccupation is not with cement as much as with cement in use—in other words with concrete. The 18 different makers of cement have, each of them, his own cement laboratory.

But, ladies and gentlemen, having thus talked at length about *you*, it remains to say a modest word about ourselves. It is not desirable, it is not dignified, it certainly is not gracious, for the host country to inflict on its guests a propaganda account of how clever and active it is. But I will say with all seriousness that we have here the will to learn. We have refrained from pushing forward our own people as readers of papers, though we cannot promise you that they will be silent in discussion.

My welcome has been general: may I make it more specific? Of the 256 delegates attending, the largest contingents are from Belgium and from Sweden; the furthermost from India and Japan; the most consistent are those delegates (22 of them) who attended also the Stockholm Symposium in 1938.

We of the CACA wish actively to be your hosts. We have made a programme which —if the weather favours us—will, I trust, please you. We are at your service: if difficulties arise, tell us about them.

Cheaper Acetic Acid

A REDUCTION in the price of all grades of acetic acid with effect from 15 September is announced by A. Boake, Roberts & Co., Ltd.

Glacial B.P. 99/100 per cent, glacial 99/100 per cent, and glacial 98/100 per cent are all reduced by £12 a ton; pure 80 per cent and technical 80 per cent are each £3 a ton less; analytical reagent is reduced by £12 and acetic anhydride by £17 a ton.

Bulk tanker allowances on glacial grades are: 2,500 gallon load less £1 a ton; 500 gallon load less 10s. a ton. On the 80 per cent grades these allowances are: 2,500 gallon load less £7 a ton; 1,000 gallon load less £5 a ton; and 500 gallon load less £4 a ton.

As a result of these reductions it has also been possible to lower the price of the following ester solvents from the same date: Ethyl acetate (to B.S. 533: 1950) reduced by £10 a ton; butyl acetate (to B.S. 551: 1950) by £6 a ton; and *iso*propyl acetate by £2 a ton.

The company also announces that with effect from 15 September reductions will take place in the price of the following plasticisers: Dinonyl phthalate by 3d. lb.; phthalate 79 by 4½d. lb.; and 1d. lb. each on diethyl hexyl phthalate, dibutyl phthalate (to B.S. 573: 1950), and diethyl phthalate (to B.S. 574: 1950).

Congress on Analytical Chemistry

700 Members from Home & Abroad Meet in Oxford

THE Analytical Section of the International Union of Pure and Applied Chemistry officially came into being in September, 1951, at the end of the International Union meeting in New York. The Congress on Analytical Chemistry, held in Oxford from 4-9 September, was therefore the first of its kind under the auspices of the Union. Nearly 700 members from all parts of the free world attended.

Registration at the Examination Schools having been proceeded with during the earlier part of Thursday, members were greeted informally by Sir Robert Robinson, the President of the Congress. That Oxford itself extended a warm welcome to the important scientific function was made amply clear by the Mayor, Alderman W. C. Walker, who, with Mrs. Walker, received and entertained the members at the Town Hall during the evening.

Papers Read

Scientific sessions, all of which were held in the Examination Schools, commenced the following morning. The outline programme was as follows:—

Period and Session	*Chairman*	*Subject*
Friday Morning :		
A	Dr. C. L. Wilson	Microchemical Methods (5 papers)
B	Dr. A. C. Menzies	Optical Methods (4 papers)
Friday Afternoon :		
A	Mr. A. L. Bacharach	Presentation of Data (3 papers)
B	Mr. B. S. Cooper	Optical Methods (2 papers)
Combined	Prof. H. V. A. Briscoe	The Ageing of Precipitates (by Prof. I. M. Kolthoff)
Saturday Morning :		
One only	Sir W. Akers	Radiochemical Methods (5 papers)
Monday Morning :		
A	Dr. J. R. Nicholls	Organic Complexes (5 papers)
B	Dr. A. J. Lindsey	Electrical Methods (5 papers)
Monday Afternoon :		
A	Mr. A. A. Smales	Adsorption and Partition Methods (3 papers)
B	Dr. J. R. Nicholls	General (2 papers)
Tuesday Morning :		
A	Dr. G. M. Bennett	Adsorption and Partition Methods (4 papers)
B	Dr. W. D. Kent-Jones	Biological Methods (3 papers)
Tuesday Afternoon :		
One only	Dr. G. M. Bennett	Adsorption and Partition Methods (2 papers)

At the close of certain of the sessions the Congress Lectures, three in number, were delivered. Speaking on Saturday morning, Dr. R. H. Müller, of Los Alamos Scientific Laboratories, New Mexico, described 'Research in Analytical Instrumentation,' while the proceedings on Monday were wound up by the address 'The Value and Economic Importance of Chemical Analysis in Industry and Manufacture,' by Dr. L. H. Lampitt, of J. Lyons & Co., Ltd., London. Immediately preceding the closing of the Congress came the final lecture, 'A Contemporary Assessment of the Place of Classical Methods in Chemical Analysis,' by Professor C. J. van Nieuwenburg, of the Technical University, Delft.

The arranging of trade exhibits of instruments, apparatus and books on the ground floor of the Examination Schools was an inspiration of the happiest kind. Members were thus enabled to inspect conveniently an impressive variety of the latest equipment. Many did this after completing registration, and then often returned.

Most Extensive Array

A little exploring, aided by a useful sketch map within the cover of the Congress exhibitions' Handbook, brought members to the Dyson Perrons Laboratory and the University Museum in South Parks Road. Here a most extensive array of new analytical techniques and apparatus, organised by Mr. F. R. Jones, of J. Lyons & Co., Ltd., was exhibited. The main exhibition occupied all available space in three laboratories and ranged from glass apparatus less than 1 cm. high to massive instruments weighing about half a ton. By invitation of Dr. R. Barer, members were able to visit the Department of Human Anatomy, University Museum, where new microscopical methods, instruments and accessories were demonstrated. In the Department of Geology and Mineralogy, the Barker Index of Crystals, for the identification of crystalline substances, was explained with the aid of exhibits.

A highly accurate analysis is of little value if performed on a sample that is not representative. A most interesting film, 'The Technique of Sampling,' produced by Imperial Chemical Industries, Ltd., was shown in the Lecture Room.

Plasticiser-Polymer Interaction

Results of Government Research

A STUDY of the effect of plasticisers on certain polymers is described in the latest volume of Selected Government Research Reports,* the principal one being the synthetic rubber derived from the copolymerisation of butadiene and acrylonitrile and known commercially as Hycar OR 15. Based on a Ministry of Supply Scientific and Technical Memorandum, this report has been prepared under extramural contract by the Geigy Co., Ltd. Attention was particularly to be directed to the influence of plasticisers on such properties as the low temperature behaviour of technical compounds and the effect of oil and petrol on such compounds.

Properties of a number of pure plasticers were examined, consideration being given to volatility, miscibility with polymers, water solubility, solubility in oils and fuels, and the viscosity/temperature relationships. Viscosity being one of the more important properties of a plasticiser, a fairly extensive field was covered in the investigation of plasticiser viscosity, all samples used in this connection being commercial products. The combined plasticiser and polymer system was tested for tensile properties, flexibility at low temperatures, ageing properties in air, hardness, and immersion in oils and petrol.

The various compounds investigated were based on the following formula, which was chosen as typifying a service compound:—

Hycar OR 15	100.0
Carbon black	50.0
Zinc oxide	5.0
Mercaptobenzthiazyl disulphide	1.5
Phenyl β-naphthylamine	1.5
Sulphur	1.5
Stearic acid	0.5
Plasticiser	40.0
	200.0

All parts are given by weight. The compounded mixture was cured for 45 minutes at 155°C., this being standard procedure. The properties of the plasticiser/polymer system were considered in the light of the experimental data obtained on the system, and wherever properties of the pure plasticiser come into question these have been discussed and correlated where possible with the plasticiser/polymer system.

Ageing Tests

In the past it has been customary in the testing of both natural and synthetic rubbers to subject the sample to an oxidation process, either in relatively still air or in oxygen, and at elevated temperatures. This test has evaluated the vulnerability of rubber to the principal process of deterioration to which it is subject. The weight loss data have not been treated with such significance, since few of the components of standard rubber mixes could be expected to be lost by evaporation in service or under test conditions which were designed to simulate service conditions. Available data on the change in weight of natural rubber on ageing indicate a net increase of the order of 1 per cent, presumably caused by combination of oxygen in excess of losses due to traces of moisture, etc.

Rupert and Gage[1] have reported in detail on the variation in weight-change of GR-S stocks on exposure to air at various humidities. They particularly relate these changes to the soap content of the various samples examined. The change in weight on exposure for 24 hours only to an atmosphere at 17°C. (relative humidity 23 per cent) was 0.1 per cent. Furthermore it is now generally accepted that synthetic rubbers age better than natural rubber, though data in the Hycar Manual give losses of 2 or 3 per cent from unplasticised vulcaniser Hycar OR 15 compounds on heat ageing.

The experimental data Hycar OR 15 show that ageing of plasticised synthetic rubbers involves two factors, namely, loss of plasticiser and deterioration of the rubber, and the net effect on mechanical properties depends on which of these two factors predominates. The effect due to deterioration of the rubber (reflected in slightly reduced ultimate tensile strength) is only of a minor character, and where plasticiser loss is high a marked increase in tensile strength is therefore apparent. Reduction in tensile strength on ageing is thus associated only with those plasticisers which possess very low vapour pressures. Compounds plasticised with tri-

* Selected Government Reports, Vol. 1, 'Plastics,' HMSO, 35s.

cresyl phosphate and Hibads show this effect. In general, the less volatile plasticisers are more completely retained by Hycar.

Similar data relating to Neoprene compounds indicate that the percentage loss of less volatile plasticiser on ageing is more than is the case with Hycar. This may be attributed to the fact that the amount of plasticiser in the compound is less in the case of Neoprene GN (11.20 per cent plasticiser in Neoprene, 20 per cent in Hycar).

Miscibility Examined

The miscibility of plasticiser and polymer was examined qualitatively and quantitatively for a number of plasticisers. It is not easy to reach any precise conclusion, so as to be able to predict accurately to what extent a particular liquid will be miscible with any polymer, but certain general conclusions can be drawn. The most outstanding fact is that none of the liquids examined have any belling action on polyamide (nylon). This may in part be due to its high molecular weight, since polymers of high molecular weight are generally more difficult to plasticise than the lower homologues, but may also be attributed to its degree of crystallisation. Gelling tests indicate that Neoprene GN is miscible with a wider range of plasticisers than is Hycar OR 15. Generally the less polar types of plasticiser (e.g., dioctyl phthalate) are compatible with Neoprene GN. Although the distinction is not clearly marked it serves in practice as a useful general rule. Poly*iso*butylene, for which results are also given, is not appreciably affected by any of the plasticisers examined.

From the results of tests it appeared generally that the absorption of petrol (0-20 hours) by plasticised rubber depends on the viscosity of the plasticisers and the degree of miscibility with petrol, similar but rather slower results being obtained with oils. With a period of 200 hours' immersion, petrol is absorbed throughout this period by unplasticised Hycar OR 15, but after this point increase in weight ceases, so that no increase in weight is apparent during the period 200 to 1,200 hours. A similar effect was observed with most of the plasticised samples over this period of time.

The greatest percentage weight change after 1,200 hours' immersion in petrol RDE/F/75 at 20°C. is shown by the most viscous material, which also has the highest petrol miscibility temperature—105°C. Products which are miscible with petrol at 20°C. are not necessarily leached out, provided their viscosity is high enough (e.g., Hibads). Applying the concept that high viscosity and high petrol miscibility temperature favour retention of plasticiser by Hycar, the figures obtained agree reasonably well, but a notable exception is Hycar plasticised with tri-butoxyethyl phosphate, which possesses low viscosity and low petrol miscibility temperature and yet exhibits a net gain in weight of the sample. Although this gain is small it is in distinct contrast to such plasticisers as dioctyl phthalate and triglycol dihexanoate, which show percentage losses. This behaviour is not easy to explain, but it is noteworthy that the addition of tri-butoxyethyl phosphate to lubricating oils which are in contact with Hycar, plasticised with the same plasticiser, tends to diminish the effect of the oil on such compositions to a greater extent than is the case with other plasticisers.

The first obvious difference between the effect of petrol and oil on plasticised Hycar is that the oil is not appreciably absorbed by the rubber, and all cases of oil immersion show a loss in weight. The processes which are involved are thus simpler than in the case of petrol immersion, and may be attributed substantially to straightforward removal of plasticiser from the rubber. Although high plasticiser viscosity reduces the rate of removal of plasticiser, the degree of miscibility exerts a more pronounced effect than in the case of petrol immersion.

Important Part Played

A review of the data obtained leads to the conclusions that both plasticer viscosity and temperature of miscibility with fuels play an important part in determining the result of immersion of plasticised Hycar OR 15 in fuels. High viscosity and high fuel resistance (high miscibility temperature) favour good retention of plasticiser. It is also apparent that the degree of interaction between the plasticiser and Hycar OR 15 can affect the course and extent of the processes in operation during the fuel immersion. The results recorded tend to indicate that Hycar OR 15 possesses enhanced affinity for tri-butoxyethyl phosphate and possibly dibenzyl ether.

Apart from effects due to the individual plasticisers, the swelling of Neoprene GN

in petrol RDE/F/75 contrasts markedly with the behaviour of Hycar OR 15. Thus, the maximum change in weight on immersion of the latter amounts to 26.2 per cent and is below 15 per cent in all other Hycar compounds examined. Neoprene GN adsorbs much greater quantities of petrol and the lowest weight increase recorded in the series examined amounts to 44.8 per cent. The nature of the absorption curve for Neoprene GN also differs from that of Hycar compounds. The former rises to a maximum, passes through a minimum, and then continues to increase even after 1,200 hours' immersion. This behaviour is common to unplasticised Neoprene and cannot therefore be attributed to the presence of plasticiser. The situation existing with Neoprene differs from Hycar in that the two essential constituents of plasticised Neoprene show an affinity for petrol. This appears to favour the absorption of petrol by the plasticiser in the rubber rather than the leaching out of the plasticiser by the petrol. With the petrol-resistant rubber (Hycar OR) the absorption of petrol by the plasticiser appears to be repressed in favour of leaching of the plasticiser.

On oil immersion plasticised Neoprene GN invariably exhibits an increase in weight in contrast to plasticised Hycar OR 15, which invariably exhibits a loss in weight.

Mechanical Properties Studied

The mechanical properties examined comprise ultimate tensile strength and elongation, British Standard Hardness Number, and low temperature flexibility for both Hycar OR 15 and Neoprene GN compounds. In addition permanent set determinations were carried out on the Neoprene GN compounds. These results have been recorded.

In the case of Hycar the lowest TS/B recorded occurs with Paraplex G 25 as plasticiser (1,541 lb./sq. in.) and this fact taken with the low elongation (317 per cent) is evidence of incompatability. Di-'Carbitol' phthalate gives the highest TS/B (3,258 lb./sq. in.) which compares favourably with unplasticised Hycar OR 15 (TS/B 3,209 lb./sq. in). This plasticiser improves E/B and cold resistance and increases the softness of the rubber when compared with the unplasticised material. The softest rubber (B.S.H.70) was obtained with dibutyl sebacate as plasticiser and tributyl phosphate gives the maximum cold resistance (151°C.).

With Neoprene GN the lowest TS/B was obtained with dibutyl sebacate as plasticiser (2,189 lb./sq. in.) and the highest with tricresyl phosphate (2,764 lb./sq. in.), although many others closely approach this figure. None of the plasticisers gives a TS/B comparable with the unplasticised material. The softest rubber is obtained with tributyl phosphate and dibutyl sebacate confers the best cold resistance. The lowest permanent set occurs with tricresyl phosphate. Since the amount of plasticiser incorporated in the Neoprene sample amounts to 11.2 per cent, the effect of plasticisation is not as marked as with Hycar, and moreover the differences between individual plasticisers are less evident.

Correlation of Mechanical Properties

Correlation of the various mechanical properties of the plasticised rubbers with the viscosity of the plasticiser has been attempted. The properties treated in this way comprise TS/B, reciprocal B.S. Hardness, and stiffening point, and in each case the graph of physical property against plasticiser viscosity is of the same form. The critical viscosity varies according to the material under consideration (Hycar or Neoprene) and also according to the particular physical property examined.

The effect of very viscous plasticisers is not as marked as might be expected, but presumably the use of liquids of higher viscosity than the polymer itself would give rise to higher tensile strength and greater hardness than the unplasticised rubbers themselves possess. It should therefore be possible by judicious choice of a plasticiser possessing very high viscosity and a low temperature-coefficient of viscosity to prepare a compound whose physical properties at normal temperatures are commensurate with or superior to the unplasticised rubber and yet of superior temperature stability. Apparently such a plasticiser would of necessity be a polymer itself, and the use of a modifying polymer or polymeric plasticiser appears to offer advantages for certain purposes. Other points in favour of this type of plasticiser would be non-volatility and resistance to leaching and migration. The moulding characteristics of such a compounded rubber, however, might not be so good as those of the uncompounded rubber. It is suggested that the physical properties of the plasticised rubbers should be a function

of their 'viscosity' rather than of plasticiser viscosity.

The data presented in the report on plasticised Hycar OR 15 and Neoprene GN permit the selection of a suitable plasticiser for these polymers for a given application. It is apparent that of any single physical property of the plasticiser, its viscosity characteristics are the most important in determining the behaviour of the plasticised polymer under mechanical test, and that viscosity also plays an important part in determining the course and extent of extraction of plasticiser on liquid immersion tests. No exact mathematical relationship between plasticiser-viscosity and a mechanical property have been derived, but general trends can be observed.

[1] *Ind. Eng. Chem.*, 37, 378 (1945).

High-Speed Operation

Pipelines Laid Across River

A UNIQUE engineering feat of laying eight pipelines simultaneously in one hour into the bed of the Suder Elbe River, Hamburg, Germany, has just been accomplished. The operation was designed to link the Shell Refinery at Harburg, on the south side of the river, with a new site for storage tanks on the north side.

The link-up marks the first occasion when so many pipelines have been laid simultaneously at such speed across a busy river which, at this point, is nearly ¼-mile wide.

Owing to the density of the river traffic and complications in the rise and fall of the tide, it was not possible to lay the pipelines (four of 10 in., two of 8 in. and two of 4 in.) by the alternative method of floating the pipelines into position on pontoons and then lowering them to the bed of the river. The pipes were laid side by side on a continous steel plate and held in correct alignment by 'U' bolts secured through wooden cross members which were placed at frequent intervals along the pipelines.

As a protection against corrosion the pipes were covered by thick coatings of bitumen and a glass fibre wrapping. The complete assembly was laid out on a launching way consisting of greased railway lines at right-angles to the river and the approaches on both the launching and landing side were cut back to ensure an easy contour down to the river bed. At the leading end was affixed a launching nose with upswept bows reminiscent of war-time landing craft.

Weighing some 160 tons in all, the launching nose and the assemblage of pipelines was connected to a 2 in. steel cable laid across the river which was attached to three of the Bundesbahn's most powerful locomotives operating on the railway sidings within the Harburg Refinery on the other side of the river.

With careful co-ordination by telephones on each side of the river, five sets of traffic lights and 'walkie-talkie' radio, the pipes were drawn at a speed of two to three miles an hour, along the launching way and across the river, and laid in a six foot channel dredged in the bed of the waterway.

By this operation the Harburg Refinery is now connected by underwater pipelines to a new site recently acquired by Shell on the north side of the river, where it is planned to begin construction immediately on a number of new storage tanks, pump and boiler houses. This project became necessary owing to the increasing demand for petroleum products as a result of the expanding Western-Germany economy. Because of the position of the Harburg Refinery, bounded on three sides by harbour basins, it was not possible to expand the existing storage facilities there, and for this reason a large area was acquired for development on the north side of the river.

Tin Research Council

THE International Tin Research and Development Council, Greenford, has recently resolved that it will in future be known as The International Tin Research Council. This change will not affect the policy of the Council, nor alter its current activities. The Council consists of delegates appointed to represent the tin mining industry in the Belgian Congo, Bolivia, Indo-China, Malaya and Nigeria. It controls the Tin Research Institute, which publishes the scientific and technical information on the properties and uses of tin, its alloys and chemical compounds. The Institute carried out its own investigations, and also co-operates with other research and industrial organisations with a view to discovering and developing new uses of tin, and assisting tin users in overcoming their difficulties and problems.

The Chemist's Bookshelf

ROCKS FOR CHEMISTS. By S. J. Shand. T. Murby & Co., London. 1952. Pp. 146 + 32 illustrations. 21s.

Professor Shand has long been held in high esteem for his bold and original contributions to geology, particularly the physico-chemical aspects of mineral and rock formation. Not only has his book 'Eruptive Rocks' truly merited the oft abused title of a 'classic' but also, his writings in more popular vein have brought an understanding and appreciation of geology to a wider public than the professional few. Consequently, this his latest book, entitled 'Rocks for Chemists,' will interest many whose studies or work combine chemistry and geology.

It comes from one who is now a professor emeritus but, as the title suggests, it is not a monograph embodying the highly advanced and technical fruits of a lifetime's study. It is, in the main, a presentation of the fundamental cycle of rock formation in the earth's crust considered in the light of known physico-chemical principles relating to the flow and crystallisation of melts and magmas. Professor Shand's classification, on a chemical basis, of the principal minerals and of the rocks formed from them will appeal strongly to chemists. The dominant position of silicon, aluminium and the metal cations is clearly emphasised and the controlling influence of their molecular proportions on rock features is well illustrated.

However, chemists accustomed to think in terms of molecular structures will regret the very scanty mention of the lattice structures of silicate minerals. The only reference to Bragg's 'Atomic Structure of Minerals' is an insignificant insertion in suggestions for further reading at the end of the book. Many of the chemists having an interest in geology are concerned with rather specialised applications of both sciences as for instance the ores required in the metallurgical industries or the materials for the ceramic industry, or, in the case of the reviewer, the scientific study of soils. It is a matter of personal opinion whether the book might have been profitably extended to deal with such aspects in more detail. Certainly the chapter on sedimentary rocks has very meagre contents and the description of the structures of clay minerals is too condensed to have much meaning except for those readers already familiar with the technicalities of clay mineralogy. On page one hundred and eleven the X-ray pattern of montmorillonite is stated to be similar to that of kaolinite but this is surely intended to be similar to that of pyrophyllite. One further point which springs to the mind after completing the reading of this book is the omission of any reference to the work of Goldschmidt on the distribution of the chemical elements in minerals and rocks, particularly the rarer metals which have assumed such great importance in geochemical studies.

The book is written in good style, it is well produced with few printing errors and is illustrated with an appendix of thirty-two very excellent photographs.—J. TINSLEY.

UNIT PROCESSES IN ORGANIC SYNTHESIS. By P. H. Groggins. Fourth Edition. McGraw-Hill Book Co., Inc., New York, 1952. Pp. 937. $12.50.

It is now nearly seventeen years since the term 'Unit Process' was first given a clear and definite meaning in the first edition of this book. Since then the value of the concept has become more and more apparent with each succeeding edition, the latest being the fourth (revised). The original intention of the editor was that the book should provide the qualified student with an introduction to the industrial world in which his theoretical knowledge is applied upon a large scale of operation. It is evident now that the original idea has been outstripped and the present content is more in the nature of a fundamental treatise. To obtain the greatest value from 'Unit Processes' the reader should be familiar with the basic principles of chemical engineering, physical chemistry and thermodynamics, in addition

to his assumed acquaintance with organic chemistry.

There are certain well-defined trends in organic manufacture which are faithfully reflected in the revised edition. The first of these is the ever increasing use of chemicals derived from petroleum. Whole new industries are being developed, and most significant from a fundamental point of view, the investigation of the chemistry of aliphatic compounds, which always tended to be neglected in favour of the more accessible aromatics, has been given a new stimulus. The second trend which is referred to in the preface to the fourth edition is the increased use which is made of thermodynamics in the design of plant to carry out specific reactions. This type of analysis has been forced upon the chemical industry largely by the need for efficiency. We are no longer in the position when stocks of precious raw materials can be squandered without thought for posterity, and this has led to a demand for the complete understanding of each process so that it may be operated with maximum efficiency. Most of the chapters have some reference to this aspect of their process and many have a detailed analysis.

Most of the processes will be familiar to the organic chemist and chemical engineer, but there is one newcomer to the book, the Oxo process, developed in Germany during the last war. The process, also called hydroformylation, was invented by Roelen and is an extension of the Fischer-Tropsch reaction for the production of liquid fuels. In essence it is the addition of the elements of formaldehyde in the form of water gas to an unsaturated compound with the formation of an aldehyde. The value of such a reaction in preparative chemical manufacture is potentially enormous, and so far only a relatively small amount of work has been carried out on a large scale outside Germany. Despite this, the chapter makes very satisfactory reading, and may stimulate further work.

With this type of book there is always a danger that the material will overlap with that made available in chemical encyclopaedias which give more or less detailed descriptions of commercial processes. On the whole this tendency has been avoided and, in the chapter upon sulphonation, eliminated to such an extent that the material has become scrappy and disconnected. It would possibly have been better to include more matter of that class and eliminate the references to the quite unimportant sulphonating agents.—J.R.M.

ILO Chemicals Group

Third Session Opens in Geneva

INCREASED productivity in the chemical and other industries depends not only on economic and technical factors but also on social ones, Luis Alvarado, Assistant Director-General of the International Labour Organisation told government, employer and worker delegates attending the opening of the Third Session of the ILO's Chemical Industries Committee on 9 September.

The meeting will continue until 20 September and is being presided over by Joseph Fafchamps of Belgium on behalf of the Governing Body of the ILO.

Mr. Alvarado pledged the Organisation's support in any research calculated to increase output since, he said, increased productivity is vital if living standards in the world are to be raised.

He said that, because of its tripartite composition, the ILO is more qualified to deal with such problems successfully than any other organisation.

Mr. Fafchamps stressed the importance of the ILO's industrial committees. He said the committees' conclusions 'are like milestones in the social progress of each industry'.

The delegates were also greeted by Gunnar Bergenstrom of Sweden and Giulio Pastore of Italy on behalf of the employers' and workers' groups of the Governing Body.

The agenda of the session is as follows:—

(1) General Report, dealing particularly with:—

(a) Action taken in the various countries in the light of the conclusions of the previous sessions;

(b) Steps taken by the Office to follow up the studies and inquiries proposed by the Committee;

(c) Recent events and developments in the chemical industries.

(2) Vocational training in the chemical industries.

(3) General problems of hours of work in the chemical industries with particular reference to a comparison of day work and shift work.

• HOME •

To Discuss Report

Sir Graham Cunningham, chairman and managing director of the Triplex group of companies, on Monday visited the Stone (Staffs) factory of Quickfit & Quartz, Ltd., manufacturers of scientific and industrial chemical glassware, to discuss his annual report to stockholders with members of the factory Joint Production and Advisory Committee. Workers from Stone will also attend the annual general meeting in London on 24 September.

Topic Altered

The paper entitled 'A Chromatographic Method for the Determination of Cholesterol in Urine,' by Ronald A. McAllister and Kenneth W. Howells, will not now be read at the meeting of the Society of Public Analysts and Other Analytical Chemists to be held on Wednesday, 1 October, in the Meeting Room of the Chemical Society, Burlington House, London, W.1. In its place a paper, 'The Estimation of Carbonyl Compounds by Semicarbazide and Hydroxylamine with Special Reference to Fatty Acid Oxidation Products,' by A. J. Feuell, B.Sc., A.R.I.C., and J. H. Skellon, M.Sc., Ph.D., F.R.I.C., will be presented.

Annual ICI Gala

More than 2,600 people sat down to tea in marquees at the annual gala of the Paints Division of Imperial Chemical Industries, Ltd., Slough, Bucks., in the grounds of Duffield House, Stoke Green. The day's programme included a fancy dress parade; fruit, vegetable and handicraft shows; a revue; children's sports; music by the Band of H.M. Grenadier Guards; and dancing. The catering was by Peter Merchant, Ltd., the industrial caterers.

50th Anniversary

As part of its 50th anniversary celebrations the Manchester College of Technology will confer three honorary associateships at a ceremony on Saturday, 11 October. The honorary recipients will be Miss Florence Horsbrugh, M.P., Minister of Education, Lord Cherwell, scientific adviser to the Government, and Alderman Wright Robinson.

British Exports of Isotopes

Britain is now the largest exporter of radioactive materials for peaceful purposes. During the year which ended in June the Ministry of Supply's Atomic Research Establishment at Harwell sent out 9,578 consignments of isotopes, of which 3,053 went by air to 37 different countries. This method of transport reduces costs by making unnecessary the use of heavy lead containers. Also, according to the Ministry, there is hardly one industry in Britain today which is not using radioactive isotopes in one form or another. A steady flow of scientists, doctors, and engineers has passed through the school at Harwell including representatives from India, Australia, South Africa, Belgium, Egypt, Greece, Holland, Israel, Italy, Norway, Spain, Sweden and Yugoslavia.

New Dyeing Process

A new continuous dyeing process, which it is claimed may revolutionise the industry, was demonstrated in London on 12 September by Mr. Leslie Clarke, managing director of William Franklin & Son, Ltd., Coventry, and his assistant Mr. Peter Hackett. The plant was invented, designed and built in the company's workshops. The process, it is said, maintains accuracy of shade over very large production, and enables the use of vat and aoic dyes.

Ketone Prices Lowered

A reduction in the prices of methyl ethyl ketone and methyl isobutyl ketone each by £6 a ton, with effect from 15 September, is announced by Shell Chemicals, Ltd.

Dearer Zinc

The Ministry of Materials announced on 12 September that the price of good ordinary brand zinc was to be raised by £4 to £126 per ton, delivered to consumer's works, effective on 13 September. Premiums remain unchanged. The increase followed a rise of half a cent per pound in the U.S.A.

First Carbon Black Exports from U.K.

A new export field is being opened up for Britain by the Cabot Carbon Company, Ellesmere Port. First shipments of carbon black from its £500,000 plant have just been sent to Turkey and Japan.

· OVERSEAS ·

Demand Growing

The synthetic textiles industry in the United States is growing at a spectacular rate, with sales mounting above the $1,000,000,000-a-year mark, according to reports. Over 50 plants comprise the bulk of the industry, these being owned by 28 different companies, and their permanent investment is estimated to be nearly $1,000,000,000. Raw materials annually cost $500,000,000, and wages another $250,000,000.

S.A. Uranium Plant

The first uranium-producing plant in South Africa will be opened by the Prime Minister, Dr. Malan, at the West Rand Consolidated Mine at Krugersdorp on 8 October.

Niobium in Norway

Niobium, which hitherto has been found almost exclusively in Nigeria, has been discovered at Söve in Telemark, Norway. Arne Drogseth, director of Norsk Bergverk A/S, the Norwegian Government's mining corporation, states that a satisfactory method of processing the ore has now been discovered, and that operations on an experimental scale will begin soon. A pilot plant is being established, and it is intended provisionally to extract about 40,000 tons of raw ore a year, and produce about 150 tons of niobium concentrate with a 50 per cent content. Dr. Drogseth states that the United States has now fixed a price for niobium which will ensure very good profits. This price will be in force for the next five years.

Brazilian Cement Plant

The construction of a new cement mill at Aratu is expected to be completed early in 1953. The output of this plant, which will use as fuel the natural gas found in the vicinity, will not only supply the requirements of the State of Bahia, but will leave a surplus for shipment to other States. The Brazilian Government is reported to be planning the organisation of a concern, called Agrobras, for the production of insecticides and fertilisers in factories to be built near the Paulo Alfonso power plant and the Cubatao refinery.

Alberta Oil Output

Crude oil production in Alberta for the first six months of 1952 was 5,960,107 barrels more than in the same period in 1951. The Petroleum and Natural Gas Conservation Board said that production for the six-month period totalled 24,863,830 barrels compared with 18,903,723 for the first half of 1951.

Good Progress Being Made

Good progress is being made on the construction of the large new aluminium plant at Sunndalsöra, West Norway. The plant will be financed largely by a United States loan to be repaid in aluminium ingots when production is started. At present 700 to 800 men are working at Sunndalsöra, and by next summer the number of construction workers will be increased to 1,500. Part of the 1,300-foot long quay has been completed and two cranes installed. The steel frames for the two main factory buildings have been ordered abroad and according to plan will be erected by next autumn. Installation of the electric furnaces will also begin next year. It is hoped to start production in one of the two halls in late 1954.

Cobalt 60 Steriliser

The Armour Research Foundation has found that cobalt-60 as a means of sterilising drugs is better than treatment with X-rays, β-rays, ultra-violet rays, high energy electrons, and radioactive slurry. It is simple, efficient, and sterilisation is effected without reducing either the potency or the life of the drugs treated. Applications to other products such as food are said to be quite promising, although obviously very much in the future as a commercial practice.

Israeli Pharmaceutical Factory

A new pharmaceutical factory owned by the United States' Near East Laboratories, has been inaugurated on the outskirts of Ramat Gan in Israel, at a cost of I£200,000 of which $100,000 was supplied by U.S. investors. Imperial Chemicals Industries has announced the purchase of I£437,000 shares in Fertilisers and Chemicals, of Haifa. The money will be used to finance the nitrogen plant.

· PERSONAL ·

SIR HAROLD WEST, managing director of Newton, Chambers & Co., Ltd., engineers and chemical manufacturers, of Thorncliffe, Sheffield, was elected Master Cutler of the Cutlers Company of Sheffield on 9 September.

MR. BRIAN H. TURPIN, technical and sales director of Quickfit & Quartz, Ltd., of Stone (Staffs.), manufacturers of scientific and industrial glassware, has been invited to address the Chemical Engineering Group of the Royal Institution of Engineers in the Netherlands at a Chemical Plant Exhibition given by the Netherlands Chemical Plant Manufacturers' Association (Vochema) in Rotterdam in October.

MR. D. P. C. NEAVE, MR. L. B. ROBINSON, and MR. A. M. BAER, vice-chairmen of the Consolidated Zinc Corporation, have in addition been appointed joint managing directors of the corporation. Besides being on the boards of various subsidiaries of the Consolidated Zinc, Mr. Neave is a director of Fisons, Mufulira Copper Mines and Wolverhampton Metal, Mr. Robinson is a director of Lloyds Bank and British Aluminium, and Mr. Baer is a director of Fricker's Metal and Chemical and a member of the Eastern Gas Board.

PROFESSOR ERNEST BALDWIN, University College, London, has been awarded the European Cortina-Ulisse Prize for 1952 for the second edition of his book 'Dynamic Aspects of Biochemistry.' The value of the prize is one million lire contributed by the Italian Ministry of Public Instruction, the province of Belluno, the hotel owners of Cortina d'Ampezzo and the Italian periodical Rivista *Ulisse*. This prize has only once before been awarded to an English author, being won in 1949 by PROFESSOR JOHN READ, of St. Andrew's University.

MR. J. C. GRIDLEY, chairman of Vacuum Oil Company, has been elected a director and chairman of Vacuum Oil Company (Ireland). In addition, MR. G. B. F. COUSENS, until recently automative lubricants manager of Vacuum Oil, succeeds as a director and manager of the Irish company MR. C. G. REEVES, who has reached the age for retirement, while MR. J. P. REIHILL, a director of a number of Irish companies, has also joined the board.

MR. H. W. ROCKE and MR. C. LAWRIE, who are directors of Vacuum Oil Company, have resigned from the board of Vacuum Oil (Ireland). MR. M. R. TYRRELL has been appointed secretary of the Irish company.

Vacuum Oil, which is jointly owned by the Powell Duffryn group and Socony-Vacuum Oil, announced recently that it had arranged to acquire a controlling interest in the Irish company from Socony-Vacuum.

Obituary

A long career devoted to work of great value to science and education was brought to a close by the death on 15 September of SIR RICHARD GREGORY, at the age of 86, at his home at Middleton-on-Sea, Sussex. One of his main achievements was as editor of *Nature* which, largely due to his personality, his impartiality, and a flair for finding the best person to write any particular article, became under his care the leading scientific journal not only of Britain, but also, to a large degree, of the world.

Born at Bristol on 29 January, 1864, Richard Arman Gregory was educated at Queen Elizabeth's Hospital, and after three years as a laboratory assistant at Clifton College, became a student at the Royal College of Science, London, where he took most interest in chemistry, physics and astronomy. He was keenly interested in education and consistently emphasised the need for all grades of the population from statesmen to labourers to have a knowledge of the main facts of science. He was author of two books for the general public 'The Vault of Heaven,' and 'Discovery,' and a number of text books on chemistry, physics and experimental science.

In 1933 Sir Richard was elected to the Fellowship of the Royal Society for his services 'to the improvement of natural knowledge.' He was elected president of the British Association for the Advancement of Science in 1939, a position which he held until 1946.

Publications & Announcements

MECHANICAL properties of ceramics and glass are described in volume 10 of the Selected Government Research Reports 'Ceramics and Glass,' published on 29 August for the Department of Scientific and Industrial Research (HMSO 25s.). This volume contains 13 reports of research work carried out during the war by the Ministries of Supply and Aircraft Production. Of these nine are devoted to ceramics and include studies of their mechanical behaviour at normal and high temperatures and under varying conditions of temperature and loading. Several deal with the properties of sintered alumina, and experiments on the hot pressing of zirconium carbide powder are also described.

* * *

AN attractive and interesting booklet 'Shaping the Needs of Industry' which is intended to serve as a guide to Royal Doulton industrial ceramics, has been published by Doulton & Co., Ltd., Albert Embankment, London, S.E.1. Probably nine out of ten people associate British pottery primarily with fine quality dinner and tea services, china figures and other decorated ceramics which are now once again becoming available in the home market. Industrial ceramics, however, are just as important a part of the industry and the booklet describes and illustrates some of the many ways in which British ceramists are contributing to the vital job of keeping the nation in the forefront of world industrial developments. Among the the topics mentioned are 'Industrial Stoneware and the Battle Against Corrosion,' 'Porous Ceramics,' 'Porcelain in the Laboratory and in Industry,' 'Ceramics in the Service of Electricity' and 'What Hygiene Owes to Clay.' Several of the firm's products in wide use in the chemical industry are illustrated.

* * *

'CYANAMID Zinc Stearate as a Lubricant in Powder Metallurgy', a technical data sheet published by the Speciality Products Department, is now available from the American Cyanamid Company, 30 Rockefeller Plaza, New York City. In the fabrication of oilless bearings, magnets and machine parts from powdered metal, it is common practice to add from 1 per cent to 3 per cent zinc or calcium stearate as a dry lubricant. Addition of metallic stearates improves the powder's ability to flow into moulds, and increases the density of the finished product by permitting closer packing of the powder under pressure.

* * *

ADVANTAGES of 'Nutradur', a form of unplasticised PVC, for use in chemical plant, are set out in two illustrated leaflets issued by Tanks & Linings, Ltd. The material, developed from the German 'Vinidur', has great chemical resistance and is now being used for standard valves from $\frac{1}{4}$ in. to 4 in. in size. 'Nutradur' is available in sheets, rods and tubes, and it can be welded by using a hot air torch and also be bent when heated to about 120° C. Its mechanical properties deteriorate, at first slowly, but then faster with increasing temperature until at 85° C. (180° F.) the strength is negligible. It is not, therefore, recommended for use at temperatures above 60°C. (140°F.).

* * *

A COMPREHENSIVE list of the principal manufacturers of chemicals used in commerce, medicine, and agriculture is contained in the 84th edition of 'The Chemical Manufacturers' Directory' for 1952 [Simpkin Marshall (1941) Ltd., 8s.]. Make up of the volume is similar to previous editions giving first, a classified list of chemicals with the makers, and followed by an alphabetical directory of manufacturers in England and Wales, Scotland, and a selection from Ireland. In quoting the chemicals made, the editor has, as far as possible, used the terms supplied by the makers themselves. A short list of chemical brokers and agents in London is again included.

* * *

THE Institute of British Photographers, of 49 Gordon Square, London, W.C.1, has issued a brochure on the subject of photography in industry. This gives a report on the function of departments of photography in industry, and the training, qualification and standing of industrial staff photographers. Also included are four appendices on general uses of photography in various fields, qualification and training of the photographer, and accommodation and equipment for photographic departments.

COMPANY MEETING

The Distillers Company, Limited

THE Seventy-fifth Annual General Meeting of the Company was held in the North British Station Hotel, Edinburgh, on Friday 12 September, 1952, when the Chairman, Sir Henry J. Ross, presided.

The Chairman said:—

I am glad to say that for the first time for many years I have nothing to report in the way of changes in the constitution of the Board.

I am sure that you will agree that it is a matter for congratulation that the results of the past year's working constitute an all-time record in the annals of the Company. The Manufacturing and Trading Profits of the Company and its Subsidiaries for the year to 31 March, 1952, reached £21,265,450. Adding to this the Income from Investments, the total Revenue for the year was £21,729,345, an increase of about £3,300,000 over the previous year. From this had to be deducted the necessary provisions for Depreciation, etc., the charge for Interest on Debentures and Loan Stocks and the Interest of outside Shareholders, leaving £18,918,909. The charge for United Kingdom Taxation, covering Income Tax, Profits Tax and Excess Profits Levy, came to nearly £11,750,000, leaving £7,170,450 as the net profit attributable to the Group. It should be emphasised at once that of the increase of £3,300,000 in Revenue, only a little over £300,000 remained as net profit although the charge for Excess Profits Levy was for a three month period only, being based on the profits for the three months from 1 January to 31 March, 1952. This was in effect a smaller figure than would have been required if it had been based on one quarter of the profits for the year.

Sum Available

Adding the balances brought forward at the start of the year, there was available £13,615,615. The Directors agreed to transfer to General Revenue Reserves £1,679,824 and to Stock Contingencies Reserves £1,561,274, while it was considered desirable to write down certain investments by £238,252. The dividends paid or proposed to be paid absorb £2,737,716, leaving to be carried forward the substantial sum of nearly £7,400,000, an increase of about £950,000.

It will be seen that, of available net profits for the year under review, the amount of £4,194,482 was 'ploughed back' into the Company.

The Directors gave careful and anxious consideration to the dividend policy and, in view of the current general difficulties of the trade, the necessity to borrow a considerable sum to continue the building up of Stocks of Whisky for maturation and sale in the future, and to the demands of the authorities for Taxation under various heads, they decided to make no change in the rate that was paid in the previous year. The Board is confident that the Stockholders will give their full support to this policy.

Taxation Demands

The Board views with great concern and anxiety the demands for Taxation made on Companies generally at the present time. In your Company in particular, because of the large expansion programme undertaken, and to a large extent carried through over the past few years, and the consequent reward now coming to the Company by way of profits, we have to face charges for considerable amounts by way of Excess Profits Levy, in addition to Income Tax and Profits Tax. To 'plough back' over £4,000,000 in a year is reasonably satisfactory, but by no means excessive, having regard to the total requirements of the Group mainly for future developments and the building up of Whisky stocks.

Heavy taxation and the increased cost of stock replacements led to the Board making an approach to the Capital Issues Committee of the Treasury with a view to borrowing a further £10,000,000. The necessary permission was granted. The Board desired, so far as it was possible to do so at the time without depressing the values of the Ordinary Stock Units, to make the finance of a permanent character. After close consideration, they decided to issue at par on 13 May, 1952, £10,000,000 5 per cent Unsecured Loan Stock redeemable in 1964 but convertible into Ordinary Stock Units between 1952/57. The Issue was heavily over-subscribed, and in making the allotment the Board had regard to the preferential claims of the Stockholders and of the Staffs, only a small percentage going to non-Stockholders. It is hoped that a large majority of holders of this Unsecured Loan Stock will avail themselves of the opportunity to convert their holdings into Ordinary Shares at some time before this right is lost in the year 1957.

In view of present market conditions and the fact that the Group held at 31 March,

1952, large stocks of raw and other materials which were valued at the lower of cost or market, the Board considered that when these stocks were used the values put on them might well prove to be inflated, and it decided to add generously to the Stock Contingencies Reserves held within the Companies. After deducting the proportion applicable to outside Stockholders, the aggregate of these Reserves available to the Group amounted to a little over £2,000,000 at 31 March, 1952. If the general level of prices should fall, and these reserves were applied, the values of the stocks of materials held would, in the opinion of the Board, be in the Inventories at safe and satisfactory figures.

The changes in the Consolidated Balance Sheet over the year under review may be summarised as follows:—

Increases:	£	£
Fixed Assets	3,626,974	
Stocks	13,645,810	17,272,784
Reductions:		
Debtors	303,215	
Cash, etc.	8,609,353	8,912,568
		8,360,216
Less: Increases in Liabilities		3,552,694
		4,807,522
representing amounts ploughed back into business.		
Revenue	£4,194,482	
Capital	613,040	4,807,522

The advance from the Associated Company, £1,500,000, has since been repaid.

The amount of £533,333 entered under heading of 'Bank Overdraft' was due by our American Subsidiary to a Bank in New York. The business of this Company has been greatly expanded over recent years and the necessary finance has been obtained from the profits ploughed back into the business. This was necessary because of the difficulty of obtaining Dollar exchange to finance the business from this side. Recently, however, further finance has been required and arrangements were made to secure this from a local Bank.

Scotch Whisky Sales

Once more I have to report that our sales policy, both at home and abroad, has been governed by considerations of National interest and will so continue until we attain a stock position capable of meeting all demands. As already mentioned, our stocks of maturing whiskies have been substantially augmented during the year under review, but a return to conditions of free supply consistent with maintenance of our high standard of quality and age is not yet possible.

The Board is determined to continue the policy of supplying a quality article at a reasonable price. Although it might well have been possible at times in the recent past to obtain higher prices for our Whisky brands, we are satisfied that to have taken advantage of the temporary conditions would not have been in the long term interest of the industry. In like manner, the successful efforts made to maintain the well established quality of our Brands have strengthened the reputation we have held for many years throughout the markets of the world.

Immature Whisky

During the year, considerable publicity has been given to the existence of a traffic in Immature Whisky which has been shipped in substantial quantities from this country to certain export markets where no restriction as to age is in operation. I can only repeat here the views which I have expressed at various Trade meetings and in discussion with Government Departments, namely, that this traffic is detrimental to the goodwill and high reputation which has been built up for Scotch Whisky over a long period of years. It is our considered opinion that the export from this country of Immature Whisky is diametrically opposed to both Trade and National interests and this opinion I know is fully endorced by the vast majority of the Trade. I profoundly hope that in the National interests and in the interests of the good name of Scotch Whisky, the responsible Government Department will shortly decide to impose a complete embargo on exports of Immature Whisky.

Following the pattern of previous years, and in accordance with the dictates of our National economy, the Dollar Markets have again received prior consideration. Because of this and the continued shortage of Whiskies of our prescribed standard of age and quality, many other important markets have perforce had to go short of supplies.

We are still experiencing obstacles and difficulties in connection with our general Export Trade. One of our more important markets—Australia—recently imposed a drastic cut of 80 per cent on importations of Scotch Whisky, followed shortly afterwards by New Zealand with a cut of 20 per cent. On the other hand, it is satisfactory to report that the position as regards South Africa has shown a marked improvement and Import Licences issued for 1952 have been substantially higher than in 1951.

I should point out that, even when we have attained a stock position capable of meeting all demands, our exports to certain markets may continue to be regulated by factors such as the issue of the necessary Import Licences and the provision of Sterling funds to meet the cost of the goods involved.

So far as the Home market is concerned,

the official figure for releases for the Trade as a whole remains as before at 2,600,000 proof gallons per annum.

The arrangements between the Government and the Industry are now on a calendar year basis and the actual releases for the year ended 31 December, 1951, were about 40 per cent above the target figure. This compares with an excess of 46 per cent which I reported at this time last year.

Gin

Our Gin sales for the year showed a reduction compared with the previous 12 months. This was due to abnormally heavy pre-Budget buying at home in the first three months of 1951.

In the United States also our Gin sales showed a slight recession due to the fact that the previous year included the commencement of the War in Korea, followed by heavy stock-piling at all levels of the Trade.

Nevertheless, results were most satisfactory and consumer acceptance of our Proprietary brands of Gin remains at a high level.

Yeast

The new Yeast Factory at Bristol neared completion in the year under review and has since come into operation. It is a model of modern design and construction and should give satisfactory results.

The other Factories have contributed good outputs and profits throughout the year.

As in the past, our Distributing Companies have endeavoured to service their large army of Customers not only with Yeast but also with the thousand and one other articles of the Bakery Trade.

Industrial Section

Throughout the various Groups which make up our industrial section, both turnover and profits for the year were a record in the history of the Company.

This is an encouraging result of the bold policy of expansion pursued by the Company since the end of the War, but it also reflects in some degree a continuance of the abnormal world-wide demand to which I referred at our last meeting. Towards the end of the year, however, a sharp recession developed in the industries we serve and this still continues. A large contributory factor to this sudden change in the state of trade is undoubtedly the heavy liquidation of stocks and at present there is no clear indication when normal buying will be resumed.

Supplies of molasses remained costly throughout the period, with resulting high prices for alcohol and its derivatives. There is no doubt that these high prices have acted as an aggravating factor in the present recession. Indications are that supplies of molasses are becoming very much easier and a fall in price is anticipated shortly. It is our intention to apply the reserve created for this purpose in writing down the cost of our stocks, in order to reduce selling prices at the earliest possible opportunity

The plant of British Petroleum Chemicals, Ltd., at Grangemouth, in which we hold an equal share with the Anglo-Iranian Oil Company, Limited, has, after some teething troubles, produced a steady output of industrial alcohol. Had this source not been available, the supply position would have been even more difficult and the price yet higher.

The supply of *iso*propyl alcohol from Grangemouth, together with the new capacity of other companies in the United Kingdom and some reduction in demand, has completely eliminated the shortage of acetone, which is now in very free supply.

In common with most construction programmes, there has been some delay in completing the styrene plant of Forth Chemicals, Limited, at Grangemouth, but it is still hoped to start commissioning this by the end of the year.

Biochemicals

The Distillers Company (Biochemicals), Limited, at Speke, enjoyed a record year in the sale of penicillin and streptomycin. Technical improvements of a very marked character, and common to all major producers have, however, brought about a startling increase in the rate of production in this industry during the last few months. In addition, new plants in Europe and elsewhere have come into operation, and for the first time since penicillin was discovered in this country, world production exceeds the current actual demand. Our own technical progress has been maintained and we believe that the efficiency and scope of our operations will assist us greatly in meeting the intensive competition—particularly in export markets—which has been in evidence during recent months.

New discoveries, variations in the trend of medical thought and other imponderable factors all combine to make the production of antibiotics a very exacting business in which the capital investments are also substantial. In this young industry, our policy has been to 'plough back' most of our profits and, by keeping abreast of the latest developments and diversifying our activities, we believe we are creating a solid founda-

tion for our future developments in this field.

With regard to our Plastics Group, the shortage of critical raw materials, to which I referred last year, showed signs of improvement towards the end of 1951, and this has continued to date. Unfortunately, however, the recession to which I have already made general reference, has been very severe in most branches of the plastics industry, and in the current year our sales of resins and moulding powders have suffered accordingly. The trading operations of British Geon, Limited, did not decline to the same extent. This can be explained by the ever-widening uses to which Geon polyvinyl chloride is being applied.

Our magnesium metal interests have made notable progress during the period under review. Last year I referred to the introduction by Magnesium Elektron, Limited, of special new alloys developed by that Company to meet the requirements of jet engine producers. With the continued progress of design, the demands of the engineering industry for light alloys with still further improved properties and able to withstand ever higher temperatures, has again been met by the development and introduction of new alloys of magnesium containing zirconium and thorium. Further licences have been granted to magnesium fabricating companies overseas.

South African Associate

Our associated company in South Africa, National Chemical Products, Limited, made encouraging progress during the past year. They have recently broadened their interest in the industrial field by the acquisition of a substantial holding in Poly-Resin Products, which Company already has an established trade in the supply of resins and adhesives in the Union.

In Australia, the operations of our associated company, Robert Corbett Proprietary, Limited, for the last financial year, were most satisfactory, although since the beginning of 1952 the recession in trade has been very marked. Stockholders will recall that I referred last year in my statement to plans for extending your Company's interests in Australia, and during the year we acquired a 40 per cent interest in what was a wholly owned subsidiary of Colonial Sugar Refining Co., Ltd., namely C.S.R. Chemicals Proprietary, Limited. This concern has recently increased its authorised capital from £3,000,000 to £6,000,000. The Distillers Company, Limited, and The Colonial Sugar Refining Company, Limited already have common interests in the chemical industry in Australia through their shareholdings in Robert Corbett Proprietary, Limited, which produces a range of organic solvents. C.S.R. Chemicals Pty., Ltd., plans to manufacture cellulose acetate for the rayon and plastic industries and a range of industrial and pharmaceutical chemicals. The main operating units are expected to be completed by the end of 1952.

The programme of capital expenditure in the United Kingdom in improved methods and new industrial products, which we have steadily pursued since the end of the war, has had to be curtailed, although I hope this is temporary. I should again emphasise —and it cannot be repeated too often—that the cost of new equipment, together with the excessive rate of taxation on profits, make it increasingly difficult to provide funds out of our resources for such investments. Reductions in capital investment for production which would contribute to the national economy can only in the long run adversely affect the competitive position and trade of our country. It is imperative that the Government should take early action to improve this position.

Future Prospects

From what I have already said, Stockholders will appreciate that, although we are reviewing a financial year which has been outstandingly successful, we have since entered upon a phase which in certain respects is less favourable.

So far, the Potable branch of the Company's business does not show any material change, and I see no reason to doubt that it will—in the main—so continue. Our Industrial Group, however, has reflected sharply the prevailing economic conditions in the United Kingdom, and, although a general improvement is looked for in the near future, the heavy recession which has taken place is bound to reveal itself in the results of the current year.

The Company is built on solid lines and has strong Reserves, and having regard to our great variety of interests it is reasonable to assume that, with our risks thus spread, we can at least look forward to producing results which will be satisfactory to our Stockholders.

Staff

Again, I must record the appreciation of the Board, and, I feel sure, also of the Stockholders, of the splendid services rendered by the Staff and all ranks of employees throughout the year.

I am also glad to say that our relations with the various trade unions represented throughout our factories have remained harmonious and constructive.

The Report was adopted.

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Market Reports

LONDON.—The demand for industrial chemicals has remained fairly steady with consumers' delivery specifications covering reasonably good quantities and buying for export, if not substantial, has at least been maintained at recent levels. Some improvement is reported in the demand from the textile and dyeing industries.

A number of price reductions have been announced operating as from 15 September. Acetic acid 98/100 per cent has been reduced by £12 per ton and the 80 per cent pure and technical grades by £3 per ton. The price of acetic anhydride is £17 per ton lower and lower prices are now ruling for the range of 'Bisol' organic chemicals. At the same time the Distillers Company announce, with effect from 15 September, the reduced price schedule for industrial alcohol and corresponding reductions have been made in the price of methylated spirit. In other directions the price position continues steady. Quiet conditions have again been reported from the coal tar products market.

MANCHESTER.—With holiday interruptions to business now at an end a fairly steady trade in heavy chemical products has been reported on the Manchester market during the past week, though the demand for bleaching, dyeing and finishing chemicals for the textile trade continues on a reduced scale. Contract deliveries to other home users of the alkalies and other leading lines are on a fair scale, and there is a reasonably steady movement of export account. Business in fertiliser materials continues to show a gradual improvement, but so far as new bookings are concerned conditions in the market for the tar products are still patchy.

GLASGOW.—The upward trend experienced a fortnight ago has been maintained and the majority of sellers report a very satisfactory week's trading. Inquiries for export have fallen off somewhat but from all accounts the position is still satisfactory.

Rubber Project for Brazil

Plans to make Brazil independent of rubber imports have been placed before Congress. Establishment of a synthetic rubber factory, possibly in the San Paulo area, is proposed, and also the setting up of a joint Government and private company to promote natural rubber production.

Next Week's Events

TUESDAY 23 SEPTEMBER

Institute of Welding

Leeds Branch: Opening address and paper by J. Berry. Details from local secretary.

WEDNESDAY 24 SEPTEMBER

Society of Chemical Industry

London: Burlington House, Piccadilly, W.1, 6.30 p.m., meeting of the Food Group. Dr. Franklin Kidd, director of the Food Investigation Organisation, Department of Scientific and Industrial Research; 'The Work of the Food Investigation Organisation, DSIR.'

Institute of Packaging

Leeds: Metropole Hotel, 6.30 p.m. Provisional Yorkshire Branch. 'Open Packaging Forum.'

THURSDAY 25 SEPTEMBER

Incorporated Plant Engineers

Sheffield: Grand Hotel, 7.30 p.m. 'Hazards and Regulations in Steelworks,' by a factory inspector.

Institute of Welding

London: Regent Street Polytechnic, 7.30 p.m. North London Branch. F. Clark, H. E. Lardge, and S. M. Reisser: 'Welding in America.'

FRIDAY 26 SEPTEMBER

Institute of Metal Finishing

Sheffield: Grand Hotel, 7.30 p.m. Sheffield and North East Branch. Address by the president, H. Silman.

Incorporated Plant Engineers

Birmingham: Imperial Hotel, 7.30 p.m. F. Jamieson: 'Modern Factory Lighting.'

To Expand Fertilisers

Taiwan is planning to expand its chemical fertiliser industry. At present, a government agency, the Taiwan Fertiliser Company, operates six plants which make ammonium sulphate, calcium cyanamide or superphosphates. Production in 1951 totalled 105,430 tons of all types. Blueprints call for enlarging the ammonium sulphate plant at Kaohsieng to increase its daily capacity from 20 to 200 tons. The idle aluminium plant at Hwalien is to be converted into a fertiliser factory, with an annual capacity of 80,000 tons. At the same time, efforts will be made to increase production of coking coal in the Keelung and Taipeh districts to meet the large fuel needs. Production target for 1952 is 132,000 tons.

B.D.H.

Micro-Analytical Reagents

'M.A.R.'

As from the 1st November, 1951, the micro-analytical reagents issued by The British Drug Houses Ltd. to which the designation 'M.A.R.' is applied will conform to new quantitative specifications which have been published separately. These revised and more exacting specifications have been approved by the Microchemistry Group of the Society of Public Analysts and other Analytical Chemists, with whose advice and assistance they were prepared

Each package of the new 'M.A.R.' reagents carries the specification on the label. An eight-page booklet giving the specifications in full may be obtained free on request.

THE BRITISH DRUG HOUSES LTD.
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Telephone: Poole 962 (6 lines)
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MAR/1

'Bisol' Price Reductions

PRICE reductions on a number of products to take effect on all despatches made on and after Monday, 15 September, have been announced by British Industrial Solvents, Ltd. The reductions are as follows:—

	Decrease
Acetic acid :	
98/100 per cent, 99/100 per cent and B.P. grades	£12 per ton
80 per cent pure	£3 ,,
80 per cent technical	£3 ,,
Deliveries of 80 per cent pure and technical acetic acid in bulk will qualify for the following allowances :—	
Minimum 2,500 gallon loads	£7 per ton
,, 1,500 ,, ,,	£5 ,,
,, 500 ,, ,,	£4 ,,
	Decrease
Acetic anhydride	£17 per ton
Butyl acetate	£6 ,,
Ethyl acetate	£10 ,,
Isopropyl acetate	£2 ,,
Bisoflex 91	3d. per lb.
Bisoflex 81 and 82	1d. ,,
Bisoflex 791	4½d. ,,
Dibutyl phthalate	1d. ,,
Diethyl phthalate	1d. ,,
Acetaldehyde	£13 per ton
Acetaldehyde 40 per cent (100 per cent basis)	£13 ,,
Crotonaldehyde	£12 ,,
Diacetin	£8 ,,
Methyl ethyl ketone	£6 ,,
Mesityl oxide	£10 ,,
Paraldehyde technical	£15 ,,
Paraldehyde stabilised	£15 ,,
Triacetin	£10 ,,

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Guest Industrials Ltd.

Raw Materials Division

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British Carbo-Norit Union, Ltd.

176, Blackfriars Rd., London, S.E.1

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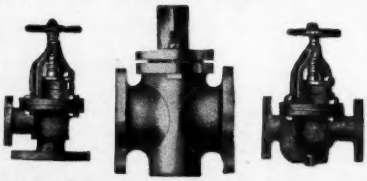

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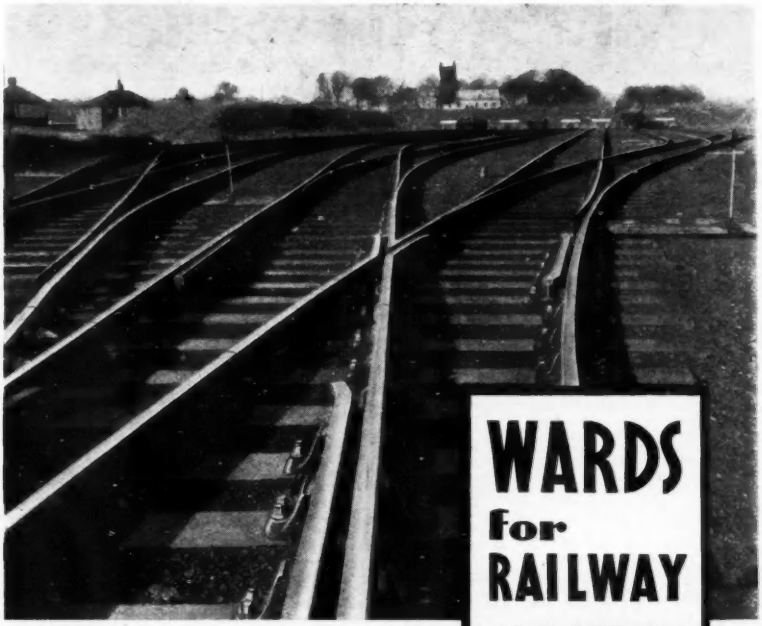

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In short, Wards have a comprehensive service on every aspect of railway siding, planning, construction and maintenance for industrial operation.

The layout illustrated above shows a ladder of sidings at the Primrose Hill Unit of the National Coal Board, by whose courtesy the photograph is reproduced.

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SC/23

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive, or a woman aged 18-59 inclusive, unless he or she, or the employment, is excepted from the provisions of the Notifications of Vacancies Order, 1952.

GRADUATE in **CHEMISTRY** or **PHYSICS,** wishing to specialise in large scale laboratory experimental work and pilot plant development, urgently required by important Chemical Manufacturers near London. A young graduate who has either completed or is taking a Chemical Engineering course would be preferred. The problems to be studied concern a new chemical process about to be operated on a large scale for a product of extending application. Opportunity offers scope for competent and imaginative man. There are excellent laboratory facilities for this class of work and an assured future for a man who makes a success of this project. A good salary will be paid and a pension scheme is in operation. Apply **BOX No. C.A. 3166,** THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

EXPERIMENTAL OFFICERS AND ASSISTANT EXPERIMENTAL OFFICERS in various Government Departments. The Civil Service Commissioners invite applications for permanent and pensionable appointments to be filled by competitive interview during 1952. A closing date for the receipt of applications earlier than December, 1952, may eventually be announced either for the competition as a whole or in one or more subjects.

The posts are divided between following main groups and subjects :—

(*a*) Mathematical and Physical Sciences ·
(*b*) Chemistry and Metallurgy ;
(*c*) Biological Sciences ;
(*d*) Engineering Subjects ; and
(*e*) Miscellaneous (including e.g., Geology, Library and Technical Information Services).

Age Limits : For Experimental Officers, at least 26 and under 31 on December 31st, 1952 ; for Assistant Experimental Officers at least 18 and under 28 on December 31st, 1952. Extension for regular service in H.M. Forces.

Candidates must have obtained, or be taking examinations during 1952 with a view to obtaining, the Higher School Certificate with Mathematics or a Science subject as a principal subject, or the General Certificate of Education in appropriate subjects, or the Higher National Certificate or other specified qualifications.

Candidates without such qualifications may be admitted exceptionally on evidence of suitable experience Candidates over 20 will generally be expected to have higher qualifications.

Inclusive London salary scales :—

Experimental Officer : £628-£786 (men) ; £533-£655 (women).

Assistant Experimental Officers : £274-£586 (men) ; £274-£490 (women).

Starting pay according to age up to 26. At 18, £274 ; at 26, £495 (men), £467 (women). Somewhat lower rates in the Provinces.

Further particulars and application forms from the Civil Service Commission, Scientific Branch, Trinidad House, Old Burlington Street, London, W.1, quoting No. S94-95/52. Completed application forms should be returned as soon as possible.
18879/50/JS.

SITUATIONS VACANT

SENIOR SCIENTIFIC OFFICERS, SCIENTIFIC OFFICERS, PATENT EXAMINER AND PATENT OFFICER CLASSES. The Civil Service Commissioners invite applications for permanent and pensionable appointments to be filled by competitive interview during 1952. Interviews will continue throughout the year, but a closing date for the receipt of applications earlier than December, 1952, may eventually be announced. The Scientific posts are in various Government Departments and cover a wide range of Scientific research and development in most of the major fields of Fundamental and Applied Science. The Patent posts are in the Patent Office (Board of Trade), Admiralty and Ministry of Supply.

Candidates must have obtained a University Degree with first- or second-class honours in an appropriate Scientific subject (including Engineering) or in Mathematics, or an equivalent qualification ; or for Scientific posts, possess high professional attainments. Candidates for Senior Scientific Officer posts must in addition have had at least three years' post-graduate or other approved experience. Candidates for Scientific Officer and Patent posts, taking their degrees in 1952, may be admitted to compete before the result of their degree examination is known.

Age Limits : Senior Scientific Officers, between 26 and 31 ; for Scientific Officers and Patent Classes, between 21 and 28 during 1952 (up to 31 for permanent members of the Experimental Officer class competing as Scientific Officers). London Salary Scales : Senior Scientific Officers (men), £812-£1,022 ; (women) £681-£917. Scientific Officers (men), £440-£707 ; (women), £440-£576. Patent Examiner and Patent Officer Classes, (men), £440-£655. (Rates for women under review.) Somewhat lower rates in the Provinces.

Further particulars from the Civil Service Commission, Scientific Branch, Trinidad House, Old Burlington Street, London, W.1, quoting No. S.53/52 for Senior Scientific Officers and S.52/52, S.128/52 for the other posts.
18878/50JS.

ASSISTANT ENGINEER required by Chemical Engineering Firm in London. Qualifications required are : Age about 30 : B.Sc. Engineering ; above average knowledge of Physics and Thermodynamics essential ; good Mathematics ; understanding of Chemistry desirable ; practical works experience essential ; understanding of general office procedure and technical sales an advantage. The position offers excellent opportunities to a man having these qualifications coupled with a keen business outlook. Write, stating age, qualifications, salary required, to **BOX No. C.A. 3165,** THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

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CHARCOAL, ANIMAL AND VEGETABLE, horticultural, burning, filtering, disinfecting, medicinal-insulating ; also lumps ground and granulated ; established 1830 ; contractors to H.M. Government.—**THOS. HILL-JONES, LTD., "INVICTA" MILLS, BOW COMMON LANE, LONDON, E. TELEGRAMS : "HILL-JONES, BOCHURCH LONDON," TELEPHONE 3285 EAST.**

GRAVITY Roller Conveyor several lengths, Rolls. 2½ in. diam. by 16 in. 3 in. centres. Good condition. **THOMPSON & SON (MILLWALL), LIMITED, CUBA STREET MILLWALL E.14.** (Tel. : East 1844.)

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VARIOUS MIXERS FOR SALE

ONE 1½ size Harrison Carter **DISINTEGRATOR.** Enclosed **STORAGE TANK,** 5 ft. 8 in. by 11 ft. 8 in. by 10 ft., deep, in Buckingham.

Two Miracle No. 1 size **HAMMER MILLS,** belt driven with fans and cyclones.

Three Perplex-type **IMPACT GRINDERS,** 24 in. and 30 in. circular grinding chambers.

Two Turner 2½-sheet No. 2 **DRESSING MACHINES,** ball bearing.

Size No. 3 Junior Hammamac **HAMMER MILL** with fan and cyclone, also No. 1 size Miracle **GRINDING MILLS.**

Robinson 3-sheet No. 1 size **CENTRIFUGAL DRESSING MACHINE** for dry powders, etc.

Two **ROTARY BOWL MIXERS,** 5 ft. diam., cast-iron built, inclined agitators by Baker Perkins

One excellent **EVAPORATING UNIT,** comprising Copper Vessel, 4 ft. diam. by 5 ft. 6 in. deep, jacketed on the bottom, with copper swan-neck, C.I. catch-pot, vacuum pump and fittings including thermometer and gauge.

Large unjacketed **WERNER MIXER,** belt and gear driven, hand tipping, double " Z " arms, pans 31 in. by 45 in. by 36 in. deep.

No. 200 One nearly new **WERNER PFLEIDERER JACKETED MIXER OR INCORPORATOR.** Low type, with C.I. built mixing chamber. 28 in. by 29 in. by 27 in. deep, with double " U "-shaped bottom which is jacketed, and double fish-tail or fin-type agitators geared together at one side, with belt-driven friction pulleys, 34 in. diam. by 5 in. face, with hand-wheel operation and hand-operated screw tilting gear. Machine fitted with machine-cut gears, covers, gear guard, cast-iron baseplate, and measuring overall approximately 7 ft. by 6ft. by 4 ft. high to the top of the tipping screw

No. 209 One **HORIZONTAL " U "-SHAPED MIXER,** steel built, riveted, measuring about 8 ft. 3 in. long by 3 ft. wide by 3 ft. 3 in. deep, with horizontal shaft, fitted with bolted-on mixing arms about 18 in. long by 4 in. wide, with intermediate breakers, and driven at one end by a pair of spur gears, with countershaft, fast and loose belt pulleys, outer bearing and plug cock type outlet at the opposite end, mounted on two cradles fitted to two R.S.J. running from end to end.

One **FILTER PRESS,** fitted 68 wood recessed plates, 2 ft. 8 in. square, centre fed, with enclosed bottom corner delivery, cloth clips and belongings.

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SIMON HORIZONTAL TUBULAR STEAM-HEATED DRIER, barrel with steam-heated tubes, 12 ft. long by 5 ft. diameter.

Further details and prices upon application.

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ONE **48 in. BROADBENT,** with stainless steel imperforate basket, complete with skimmer attachment. Electrically driven.

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All the above machines are 3-point suspension type complete with baseplates. All the electrically driven are complete with starters and suitable for 400/3/50 supply.

TWO **42 in.** by **WATSON LAIDLAW,** under-driven through Vee-ropes from flange-mounted vertical spindle motor, complete with starter. 400/3/50 supply.

TWO de Laval Motorised Centrifugal **SEPARATORS,** 150 gallons per hour.

THREE Hopkinson Motorised Centrifugal **SEPARATORS,** 150/200 g.p.h. Types 1 and 2.

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" MORWARD " " U "-shaped TROUGH POWDER MIXERS in sizes 8 to 100 cu. ft. Arranged with scroll-type mixing gear.

WE SPECIALISE IN MAKING MIXERS, JACKETED AND UNJACKETED, TO SUIT REQUIREMENTS.

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NEW 100g., 150g. and 200g. in mild steel, suitable for 80/100 p.s.i. w.p.

SECOND-HAND, one 200g. in cast iron, arranged with nickel-chrome mixing gear, totally enclosed, fume-tight cover.

ONE 1,500g. in mild steel, second-hand.

SEVERAL 40/60g. second-hand, in mild steel and cast iron available.

All the above can be fitted with mixing gear to requirements.

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A large selection of **PUMPS** in stock—**MONOS, DRYSDALES,** etc.—1 in. 2 in., 3 in., 5 in. and 6 in. New and second-hand.

Numerous all-bronze, brass tube, **CONDENSERS** or **HEAT EXCHANGERS** by Serck in stock.

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CHEMICAL PLANT

50—Vessels, 6 ft. diam. by 5 ft. 9 in. deep, conical bottom, 2 in., porcelain lined.
20—Vessels, 6 ft. diam. by 5 ft. 9 in. deep, conical bottom, unlined.
20—Vessels, 6 ft. diam. by 3 ft. 10 in. deep, internally coned, 2 in., porcelain lined.
50—Vessels, 2 ft. 9 in. diam. by 3 ft. 9 in. deep, 2 in., porcelain lined.
38—Vessels, mild steel, 3 ft. 2 in. diam. by 3 ft. 7 in. deep.
12—Vessels, mild steel, 4 ft. 6 in. diam. by 3 ft. 3 in. deep (all Tile lined for Acid).
35—Stainless Steel Bends, 6 in. diam.
7—Stainless Steel Separators, 4 ft. 4 in. by 20 in. diam.
Various Mild Steel and Bakelite Lined Tanks.
Inspection :- Midlands, by arrangement.
Apply :
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NEW GALVANISED PIPING. Immediate delivery.

FIVE new **FURNACE RETORTS,** 8 ft. diam., 6 ft. 8 in. deep, approx. 8 tons each. Welded Steel.
BENZOLE WASHER, lead lined, agitating gear, 7 ft. diam., 6 ft. 6 in. deep.
FIVE Dish-ended **NAPHTHA TANKS,** 18 ft. 6 in. long by 4 ft. 4 in. diam., two having agitators.
NINE New Welded **TANKS,** 13 ft. 6 in. long, 7 ft. diam., 3,100 gallons each.
TWO 35 ft. long by 9 ft. diam. Lead-lined **TANKS.**
Stainless Steel **FILTER TANK,** 3 ft. 6 in. diam.
ONE Stainless **CONICAL HOPPER,** 7 ft. 3 in. diam., overall depth, 7 ft. 6 in.
TWO Broadbent **WATER-DRIVEN CENTRIFUGES,** 30 in. diam., 12 in. deep, 1,150 r.p.m., 150 lb. pressure.
FOUR Papier-mache O.T. **TANKS,** 8 ft. 3 in. diam., 9 ft. deep. (Unused.)
SIX O.T. TANKS, 7 ft. diam. 14ft. deep, lined inside with acid-resisting bricks.
SIX Aluminium CONDENSERS, 14 ft. long by 2 ft. 6 in diam. 386 Tubes, ¾ in. o.d.
FOUR Rectangular Lead-lined **TANKS,** 8 ft. by 4 ft. 6 in. by 2 ft. 6 in.
FORTY Riveted **RECEIVERS,** 8 ft. 6 in. long, 5 ft. 6 in. diam., 75 lbs. w.p.
CAST-IRON PIPES and FITTINGS, 200 tons.
VALVES in Stainless, Gunmetal, Enamel Lined.
Free Catalogue, "Watkins Machinery Record," available.

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MANGANESE BRONZE TUBES. Approximately 1½ tons in two sizes, mixed :—(*a*) 1¼ in. o.d. by 1 ⅛ in. i.d. lengths, 12/14 ft. (*b*) 1 $\frac{5}{16}$ in. o.d. by 1 in. i.d., lengths 12/14 ft.

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PAIR "Watson Laidlaw" Electric Hydros, 30 in. diam. monel baskets (bottom discharge). 400/3/50.
W.S. Jacketed Vertical Cylindrical Enclosed Mixer, 8 ft. 6 in. by 5 ft. 9 in. diam.
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Welded Steel Jacketed Mixing Pans, 25 in. by 25 in., 50 lb. p.s.i.
Duplex "Z" and "Werner" Tipping Mixers, up to 10 cwt. capacity.
Two R.S. Calorifiers, 6 ft. by 3 ft., 275 sq. ft. "U" tubes.
Ditto, 6 ft. by 3 ft., by Royles (unused).
Four 4,000 gal. Unused W.S. Enclosed Tanks, 15 ft. by 7 ft. by 7 ft., ⅜ in. plate.
CONDENSERS, REFINERS, STILLS, PUMPS, BOILERS, DRYERS, OVENS, HYDROS, ETC.

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SCREENLESS PULVERIZERS for fine grinding of Chemicals. Also CYCLONES, ROTARY VALVE FEEDERS. Callow (Engrs.) Ltd. Kirkby Trading Est., Liverpool.

1 **Barron "D" MIXER, TROUGH** 30 in. by 18 in by 18 in. Vee-belt drive to 2 H.P. motor, 750 revs 400/3/50. As new.
One Werner Type **MIXER, TROUGH** 36 in. by 30 in. by 28 in. Twin "Z"-blades, power tilted, fast and loose pulley drive.

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6 ft. diam. Rotating Type **PAN MILL** by Thos. C. Fawcett. Pan, 10 in. deep with ⅜ in. perforations. Fixed pan beneath fitted scrapers and two outlets, each 17 in. by 9 in. Twin C.I. rolls, 36 in. diam. by 10 in. face. Pulley drive.
Continuous **BALL MILL** by Vickers-Armstrong. 7 ft. 3 in. diam. by 8 ft., of ⅜ in. M.S. plate. Two compartments : First, 2 ft. 5 in. long, with C.I. lining ; the second, 4 ft. 7 in. long with cast steel stepped liners. Drive through David Brown reduction gear.
SWING HAMMER MILL by Sturtevant. Beater chamber, 2 ft. diam. by 1 ft. with 19 in. by 12 in. feed opening. Rotor on 2½ in. diam. shaft carries 20 swing hammers. Motorised 400/3/50 through reduction gear.
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Rotex **SIFTING MACHINE** by Locker, Type 11. Single screening surface, 48 in. by 20 in. by 25 mesh. Fitted clamped wooden cover, M.S. feed hopper and delivery chute. Motorised, 400/3/50.
300-gal. C.I. totally enclosed **MIXER,** 5 ft. diam. by 3 ft. 6 in. deep. Agitator with adjustable blades, driven by fast and loose pulleys through reduction gear.
Vertical **C.I. MIXER,** 3 ft. 3 in. internal diam. by 7 ft. deep on straight with 6 in. top and bottom dished sections. Totally enclosed, coil heated. Paddle-type agitator on 2 in. glanded shaft.
TROUGH MIXER, 49 in. by 41 in. by 31 in. with twin "Z" mixing blades, fitted counter-balance lid. Motorised 50 h.p., 415/3/50. through reduction gear. Quadrant power tilting gear driven by 5 h.p. motor.
SIFTER MIXER by Porteous, 62 in. by 27 in. by 32 in. deep. Scroll-type agitator. Brush sifter. Driven through gearing by "V" rope drive from 6 h.p. S/R Brook motor, 415/3/50.
Two Underdriven **HYDRO EXTRACTORS** by Broadbent. Perforated galvanised basket, 21 in. diam. by 11 in. deep. Motorised, 110 V.D.C.

GEORGE COHEN SONS & CO., LTD.,
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Tel. : Elgar 7222 and
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TRANSLATIONS

TRANSLATIONS (Technical, Commercial), all languages. Abstracts also supplied. Olympia Translation Service. 149, Blythe Road, London, W.14. **RIVerside 5135.**

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DOHM, LTD., have 14 factories for pulverising, grinding, mixing and drying raw materials. Trade inquiries to Dohm, Ltd., 167, Victoria Street, London, S.W.1. (VIC. 1414.)

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GRINDING of every description of chemical and other materials for the trade with improved mills. THOS. HILL-JONES, LTD. "INVICTA" MILLS, BOW COMMON LANE, LONDON, E. TELEGRAMS: "HILL-JONES, BOCHURCH, LONDON" TELEPHONE: 3385 EAST.

WORKING NOTICES

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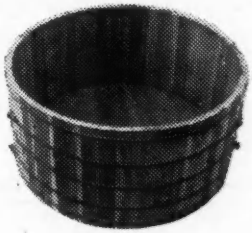

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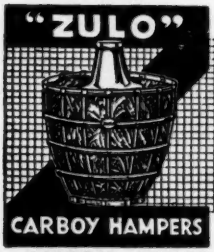

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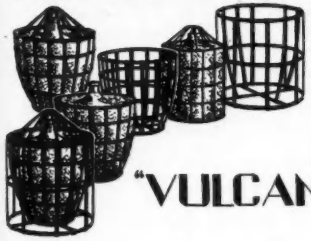

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